PHILIPS

Data handbook

Electronic
components
and materials

Electron tubes

Part 8 February 1982

TV picture tubes

Monitor tubes

Components

ELECTRON TUBES

PART 8 - FEBRUARY 1982

PICTURE TUBES AND COMPONENTS

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DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of four series of handbooks each comprising several parts.

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INTEGRATED CIRCUITS	PURPLE
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The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

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ELECTRON TUBES (BLUE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**February 1980**	**T1 02-80** **(ET1a 12-75)**	**Tubes for r.f. heating**
Part 2	**April 1980**	**T2 04-80** **(ET1b 08-77)**	**Transmitting tubes for communications**
Part 2b	**May 1978**	**ET2b 05-78**	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators.
Part 3	**June 1980**	**T3 06-80** **(ET2a 11-77)**	**Klystrons, travelling-wave tubes, microwave diodes**
Part 3	**January 1975**	**ET3 01-75**	**Special Quality tubes, miscellaneous devices**
Part 4	**September 1980**	**T4 09-80** **(ET2a 11-77)**	**Magnetrons**
Part 5	**August 1981**	**T5 08-81** **(ET5a 10-79)**	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications.
Part 6	**July 1980**	**T6 07-80** **(ET6 01-77)**	**Geiger-Müller tubes**
Part 7a	**March 1977**	**ET7a 03-77**	**Gas-filled tubes** Thyratrons, industrial tubes, ignitrons, high-voltage rectifying tubes.
Part 7b	**May 1979**	**ET7b 05-79**	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units.
Part 8	**February 1982**	**T8 02-82** **(ET8 07-79)**	**Picture tubes and components** Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display.
Part 9	**June 1980**	**T9 06-80** **(ET9 03-78)**	**Photo and electron multipliers** Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates.
Part 10	**May 1981**	**T10 05-81** **(ET5b 12-78)**	**Camera tubes and accessories, image intensifiers**

SEMICONDUCTORS (RED SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**March 1980**	**S1 03-80** **(SC1b 05-77)**	**Diodes** Small-signal germanium diodes, small-signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
Part 2	**May 1980**	**S2 05-80** **(SC1a 08-78)**	**Power diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs
Part 3	**April 1980**	**S3 04-80** **(SC2 11-77, partly)** **(SC3 01-78, partly)**	**Small-signal transistors**
Part 4	**September 1981**	**S4 09-81** **(SC2 06-79)**	**Low-frequency power transistors**
Part 4a	**December 1978**	**SC4a12-78**	**Transmitting transistors and modules**
Part 5	**October 1980**	**S5 10-80** **(SC3 01-78, partly)**	**Field-effect transistors**
Part 7	**December 1980**	**S7 12-80** **(SC4c 07-78)**	**Microminiature semiconductors for hybrid circuits**
Part 8	**April 1980**	**S8 06-81** **(SC4b 09-78)**	**Devices for optoelectronics** Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices
Part 10	**September 1981**	**S10 09-81** **(SC3 01-78, partly)**	**Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code. Books with the purple cover will replace existing red covered editions as each is revised.

Part 1	**May 1980**	**IC1 05-80** **(SC5b 03-77)**	**Bipolar ICs for radio and audio equipment**
Part 2	**May 1980**	**IC2 05-80** **(SC5b 03-77)**	**Bipolar ICs for video equipment**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 4	**October 1980**	**IC4 10-80** **(SC6 10-77)**	**Digital integrated circuits** LOCMOS HE4000B family
Part 6b	**August 1979**	**SC6b 08-79**	**ICs for digital systems in radio and television receivers**
Part 7	**May 1981**	**IC7 05-81**	**Signetics Bipolar memories**
Part 8	**May 1981**	**IC8 05-81**	**Signetics Analogue circuits**
Part 9	**November 1981**	**IC9 11-81**	**Signetics TTL Logic**

COMPONENTS AND MATERIALS (GREEN SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**October 1981**	**C1 10-81**	**Assemblies for industrial use** PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs, peripheral devices
Part 2	**June 1981**	**C2 06-81** **(CM3a 09-78)**	**FM tuners, television tuners, video modulators, surface acoustic wave filters**
Part 3	**January 1981**	**C3 01-81** **(CM3b 10-78)**	**Loudspeakers**
Part 4	**December 1981**	**C4 12-81**	**Ferroxcube potcores, square cores and cross cores**
Part 4a	**November 1978**	**CM4a 11-78**	**Soft Ferrites** Ferrites for radio, audio and television, beads and chokes, FXC potcores and square cores, FXC transformer cores
Part 6	**May 1981**	**C6 05-81** **(CM6 04-77)**	**Electric motors and accessories** Permanent magnet synchronous motors, stepping motors, direct current motors
Part 7a	**January 1979**	**CM7a 01-79**	**Assemblies** Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	**September 1981**	**C8 09-81** **(CM8 06-79)**	**Variable mains transformers**
Part 9	**August 1979**	**CM08-79**	**Piezoelectric quartz devices** Quartz crystal units, temperature compensated crystal oscillators
Part 10	**October 1980**	**C10 10-80**	**Connectors**
Part 11	**December 1979**	**CM11 12-79**	**Non-linear resistors** Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
Part 12	**November 1979**	**CM12 11-79**	**Variable resistors and test switches**
Part 13	**December 1979**	**CM13 12-79**	**Fixed resistors**
Part 14	**April 1980**	**C14 04-80** **(CM2b 02-78)**	**Electrolytic and solid capacitors**
Part 15	**May 1980**	**C15 05-80** **(CM2b 02-78)**	**Film capacitors, ceramic capacitors, variable capacitors**
Part 16	**January 1982**	**C16 01-82** **(CM4b 02-79)**	**Piezoelectric ceramics, permanent magnet materials**

GENERAL SECTION
TV PICTURE TUBES AND MONITOR TUBES

A

LIST OF SYMBOLS

Symbols denoting electrodes/elements and electrode/element connections

f	Heater
k	Cathode
g	Grid: Grids are distinguished by means of an additional numeral; the electrode nearest to the cathode having the lowest number.
a	Anode
m	External conductive coating
m^1	Rim band
ℓ	Fluorescent screen
i.c.	Tube pin which must not be connected externally
n.c.	Tube pin which may be connected externally

Symbols denoting voltages

Unless otherwise stated, the reference point for electrode voltages is the cathode.

V	Symbol for voltage, followed by a subscript denoting the relevant electrode/element
V_f	Heater voltage
V_{pp}	Peak-to-peak value of a voltage
V_p	Peak value of a voltage
V_{GR}	Grid 1 voltage for visual extinction of focused raster (grid drive service)
V_{KR}	Cathode voltage for visual extinction of focused raster (cathode drive service)

Symbols denoting currents

I	Symbol for current followed by a subscript denoting the relevant electrode
I_f	Heater current (r.m.s. value)

Note: The symbols quoted represent the average value of the current, unless otherwise stated.

Symbols denoting powers

P_ℓ	Dissipation of the fluorescent screen
P_g	Grid dissipation

Symbols denoting capacitances

See IEC publication 100

Symbols denoting resistances and impedances

R	Symbol for resistance followed by a subscript for the relevant electrode pair. When only one subscript is given the second electrode is the cathode.
Z	Symbol for impedance followed by a subscript for the relevant electrode pair. When only one subscript is given the second electrode is the cathode.

Symbols denoting various quantities

L	Luminance
f	Frequency
H	Magnetic field strength

GENERAL OPERATIONAL RECOMMENDATIONS

INTRODUCTION

Equipment design should be based on the characteristics as stated in the data sheets. Where deviations from these general recommendations are permissible or necessary, statements to that effect will be made.

If applications are considered which are not referred to in the data sheets of the relevant tube type extra care should be taken with circuit design to prevent the tube being overloaded due to unfavourable operating conditions.

SPREAD IN TUBE CHARACTERISTICS

The spread in tube characteristics is the difference between maximum and minimum values. Values not qualified as maximum or minimum are nominal ones. It is evident that average or nominal values, as well as spread figures, may differ according to the number of tubes of a certain type that are being checked. No guarantee is given for values of characteristics in settings substantially differing from those specified in the data sheets.

SPREAD AND VARIATION IN OPERATING CONDITIONS

The operating conditions of a tube are subject to spread and/or variation.

Spread in an operating condition is a **permanent** deviation from an average condition due to, e.g., component value deviations. The average condition is found from such a number individual cases taken at random that an increase of the number will have a negligible influence.

Variation in an operating condition is **non-permanent** (occurs as a function of time), e.g., due to supply voltage fluctuations. The average value is calculated over a period such that a prolongation of that period will have negligible influence.

LIMITING VALUES

Limiting values are in accordance with the applicable rating system as defined by IEC publication 134. Reference may be made to one of the following 3 rating systems.

Absolute maximum rating system. Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment components spread and variation, equipment control adjustment, load variations, signal variation, environmental conditions, and spread or variations in characteristics of the device under considerations and of all other electronic devices in the equipment.

Design-maximum rating system. Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and thoughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design-centre rating system. Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under average conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component spread and variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations or spread in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device* in equipment operating at the stated normal supply voltage.
If the tube data specify limiting values according to more than one rating system the circuit has to be designed so that none of these limiting values is exceeded under the relevant conditions.

In addition to the limiting values given in the individual data sheets the directives in the following paragraphs should be observed.

HEATER SUPPLY

For maximum cathode life it is recommended that the heater supply be stabilized at the nominal heater voltage. Any deviation from this heater voltage has a detrimental effect on tube performance and life, and should therefore be kept to a minimum. Such deviations may be caused by:

- mains voltage fluctuations;
- spread in the characteristics of components such as transformers, resistors, capacitors, etc.;
- spread in circuit adjustments;
- operational variations.

Supply from mains transformer

The maximum deviation of the heater voltage must not exceed ± 15% (Design Maximum Value). A mains transformer will generally fulfil this condition at mains voltage fluctuations not exceeding ± 10%.

Supply from line output transformer

A deviation from the nominal heater voltage due to spread in component characteristics and adjustments should not exceed ± 7,5%. Considering all other possible deviations, due to mains voltage variations, beam current variations, VCR-operation, etc., the total spread in heater voltage must not exceed ± 15%.

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* A bogey tube is a tube whose characteristics have the published nominal values for the type. A bogey tube for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Standby (instant-on circuits)

The majority of tubes employ quick-heating cathodes and therefore an instant-on circuit is superfluous. If used, it is recommended to that the heater voltage of the tubes be reduced during standby operation to 75% of the nominal value.

Notes: If series connection of the heater circuit has to be used, and only parallel connection is quoted in the data sheet, please contact your local supplier.

Picture tubes with quick-heating cathodes should not be used in series with receiving tubes.

CATHODE TO HEATER VOLTAGE

The voltage between cathode and heater should be as low as possible and never exceed the limiting values given in the data sheets of the individual tubes. The limiting values relate to that side of the heater where the voltage between cathode and heater is greatest. The voltage between cathode and heater may be d.c., a.c., or a combination of both. Unless otherwise stated, the maximum values quoted indicate the maximum permissible d.c. voltage. If a combination of d.c. and a.c. voltages is applied, the peak value may be twice the rated V_{kf}; however, unless otherwise stated, this peak value shall never exceed 315 V. Unless otherwise stated, the V_{kf} max. holds for both polarities of the voltage; however, a positive cathode is usually the most favourable in view of insulation during life.

In order to avoid excessive hum the a.c. component of the heater to cathode voltage should be as low as possible and never exceed 20 V r.m.s. (mains frequency). A d.c. connection should always be present between heater and cathode. Unless otherwise specified the maximum resistance should not exceed 1 MΩ; the maximum impedance at mains frequency should be less than 100 kΩ.

INTERMEDIATE ELECTRODES (between cathode and final accelerator)

In no circumstances should the tube be operated without a d.c. connection between each electrode and the cathode. The total effective impedance between each electrode and the cathode should never exceed the published maximum value. However, no electrode should be connected directly to a high energy source. When such a connection is required, it should be made via a series resistor of not less then 1 kΩ.

CUT-OFF VOLTAGE

Curves showing the limits of the cut-off voltage as a function of grid 2 voltage are generally included in the data. The brightness control should be so dimensioned that it can handle any tube within the limits shown, at the appropriate grid 2 voltage.

The published limits are determined at an ambient illumination level of 10 lux. Because the brightness of a spot is in general greater than that of a raster of the same current, the cut-off voltage determined with the aid of a focused spot will be more negative by about 5 V as compared with that of a focused raster.

FOCUSING ELECTRODE VOLTAGE

Individual tubes will have satisfactory focus over the entire screen at some value within the published range of the focusing voltage.

Due to their flat focus characteristics, black and white picture tubes can generally be operated at a fixed focusing voltage within the published range. Colour picture tubes and monitor tubes for data display should have adjustable focus.

LUMINESCENT SCREEN

To prevent permanent screen damage, care should be taken:

- not to operate the tube with a stationary picture at high beam currents for extended periods;
- not to operate the tube with a stationary or slowly moving spot except at extremely low beam currents;
- if no e.h.t. bleeder is used, to choose the time constants of the cathode, grid 1, grid 2, and deflection circuits, such that sufficient beam current is maintained to discharge the e.h.t. capacitance before deflection has ceased after equipment has been switched off.

EXTERNAL CONDUCTIVE COATING

The external conductive coating must be connected to the chassis. The capacitance of this coating to the final accelerating electrode may be used to provide smoothing for the e.h.t. supply.

The coating is not a perfect conductor and in order to reduce electromagnetic radiation caused by the line time base and the picture content it may be necessary to make multiple connections to the coating. See also 'Flashover'.

METAL RIMBAND

An appreciable capacitance exists between the metal rimband and the internal conductive coating of the tube; its value is quoted in the individual data sheets.To avoid electric shock, a d.c. connection should be provided between the metal band and the external conductive coating. In receivers where the chassis can be connected directly to the mains there is a risk of electric shock if access is made to the metal band. To reduce the shock to the safe limit, it is suggested that a 2 MΩ resistor capable of handling the peak voltages be inserted between the metal band and the point of contact with the external conductive coating. This safety arrangement will provide the necessary insulation from the mains but in the event of flashover high voltages will be induced on the metal band. It is therefore recommended that the 2 MΩ resistor be bypassed by a 4,7 nF capacitor capable of withstanding the peak voltage determined by the voltage divider formed by this capacitor and the capacitance of the metal rimband to the internal conductive coating, and the anode voltage. The 4,7 nF capacitor also serves to improve e.h.t. smoothing by adding the rimband capacitance to the capacitance of the outer conductive coating.

FLASHOVER

High electric field strengths are present between the gun electrodes of picture tubes. Voltages between gun electrodes may reach values of 20 kV over approx. 1 mm. Although the utmost precautions are taken in the design and manufacture of the tubes, there is always a chance that flashover will occur. The resulting transient currents and voltages may be of sufficient magnitude to cause damage to the tube itself and to various components on the chassis. Arcing terminates when the e.h.t. capacitor is discharged. Therefore it is of vital importance to provide protective circuits with spark gaps and series resistors, which should be connected according to Fig. 1. No other connections between the outer conductive coating and the chassis are permissible.

In picture tubes which are manufactured in Soft-Flash technology, the peak discharge currents are limited to approx. 60 A, offering higher set reliability, optimum circuit protection and component savings (see also Technical Note 039). However this limited value of 60 A is still too high for the circuitry which is directly connected to the tube socket. Therefore Soft-Flash picture tubes should also be provided with spark gaps.

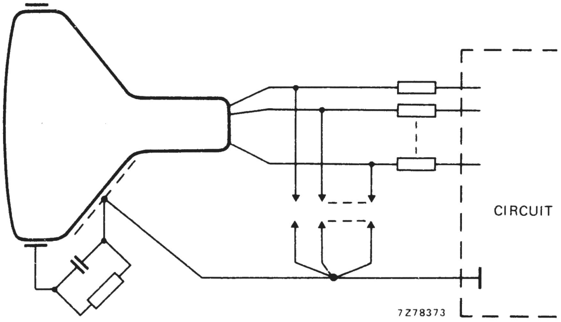


Fig. 1.

IMPLOSION PROTECTION

All picture tubes employ integral implosion protection and must be replaced with a tube of the same type number or recommended replacement to assure continued safety.

HANDLING

Although all picture tubes are provided with integral implosion protection, which meets the intrinsic safety requirements stipulated in the relevant part of IEC 65, care should be taken not to scratch or knock any part of the tube. **Stress on the tube neck must be avoided.**

When lifting a tube from the edge-down position, one hand should be placed around the parabola section of the cone and the other hand should be placed under the rim band (Fig. 2).

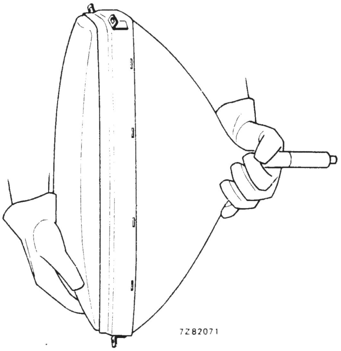


Fig. 2 Lifting picture tube from edge-down position.

When placing a tube face downwards ensure that the screen rests on a soft pad of suitable material, kept free from abrasive substances. When lifting from the face-down position the hand should be placed under the areas of the faceplate close to the mounting lugs at diagonally opposite corners of the faceplate (Fig. 3).

When lifting from the face-up position the hands should be placed under the areas of the cone close to the mounting lugs at diagonally opposite corners of the cone (Fig. 4).

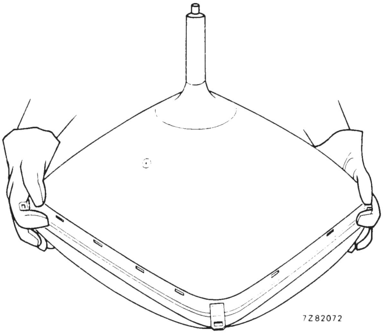


Fig. 3 Lifting picture tube from face-down position.

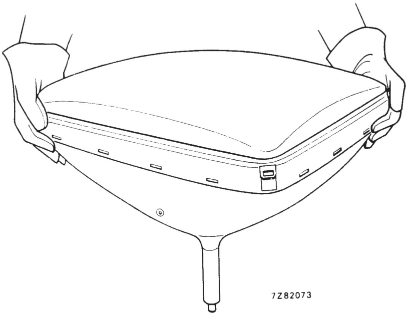


Fig. 4 Lifting tube from face-up position.

In all handling procedures prior to insertion in the receiver cabinet there is a risk of personal injury as a result of severe accidental damage to the tube. It is therefore recommended that protective clothing should be worn, **particularly eye shielding.**

If suspending the tube from the mounting lugs ensure that a **minimum of 2** are used; UNDER NO CIRCUMSTANCES HANG THE TUBE FROM ONE LUG.

The slots in the rimband of colour picture tubes are used in the mounting of the degaussing coils. It is not recommended to suspend the tube from one or more of these slots as permanent deformation to the rimband can occur.

Remember when replacing or servicing the picture tube that a residual electrical charge may be carried by the anode contact and also the external coating if not earthed. Before removing the tube from the equipment, earth the external coating and short the anode contact to the coating.

PACKING

The packing provides protection against tube damage under normal conditions of shipment or handling. Observe any instructions given on the packing and handle accordingly. The tube should under no circumstances be subjected to accelerations greater than 35 g.

MOUNTING

Unless otherwise specified on the data sheets for individual tubes there are no restrictions on the position of mounting.

The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The mass of the socket and additional circuitry should not be more than 150 g. The socket of tubes with a 7-pin miniature base may not be used for mounting components.

It is very desirable that tubes should not be exposed to strong electrostatic and magnetic fields.

DIMENSIONS

In designing the equipment the tolerances given on the dimensional drawings should be considered. Under no circumstances should the equipment be designed around dimensions taken from individual tubes.

REFERENCE LINE

Where a reference line is indicated on the tube outline drawing, it is determined by means of a gauge. Drawings of the gauges are given in this section under "Reference line gauges"

TYPE DESIGNATION

PRO ELECTRON TYPE DESIGNATION CODE

The type number of the picture tubes consists of:
Single letter, group of figures, hyphen, group of figures, letter or letter group.

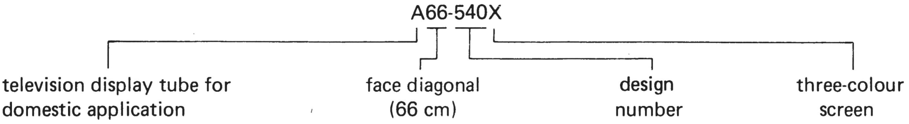
The first letter indicates the prime application of the tube:
A – Television display tube for domestic application.
M – Monitor tube for video and data display.

First group of figures: diameter or diagonal of the face in cm.

Second group of figures: design number.

Final letter or letter group: properties of the phosphor screen.
The first letter denotes the colour of the fluorescence; the second letter, if any, denotes other specific differences in screen properties.
W – White screen for television and data display tubes.
X – Three-colour screen for television display tubes.
GH – Green screen for video and data display tubes (medium-short persistence).
GR – Green screen for video and data display tubes (long persistence).

Example


A66-540X
television display tube for domestic application
face diagonal (66 cm)
design number
three-colour screen

SCREEN PHOSPHORS

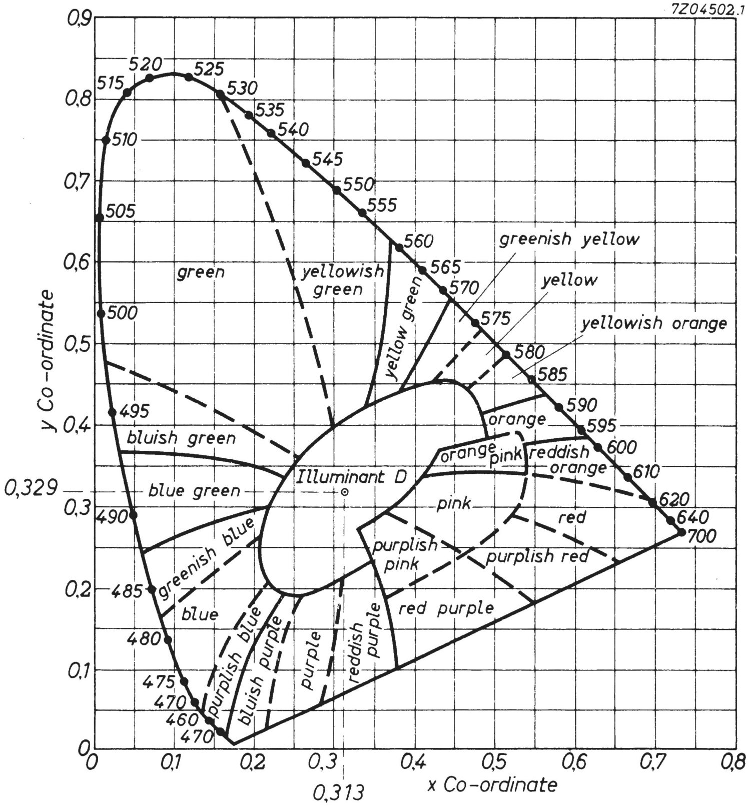


Fig. 1 Kelly chart.

Note: For screen phosphors for colour picture tubes, see the relevant data sheets.

Survey of screen phosphors

type	JEDEC designation	fluorescent colour	phosphorescent colour	persistence	relative level of luminance			
					10%	1%	0,1%	
W	P4	white	–	–	1,3 ms 1,3 ms	23 ms 20 ms	210 ms 180 ms	(yellow component) (blue component)
GH	P31	green	green	medium short	600 μs	8 ms	90 ms	
GR	P39	green	green	long	100 ms	1,4 s	9 s	
KC	–	yellow-green	yellow-green	medium short	1,3 ms	23 ms	210 ms	
X	–	colour screen	–	–	–	–	–	

The values in the table are measured under the following operation conditions.

Final accelerator voltage	10 to 18 kV
Screen current	0,1 μA/cm^2
Focusing	defocused
Excitation	sufficient for complete build-up

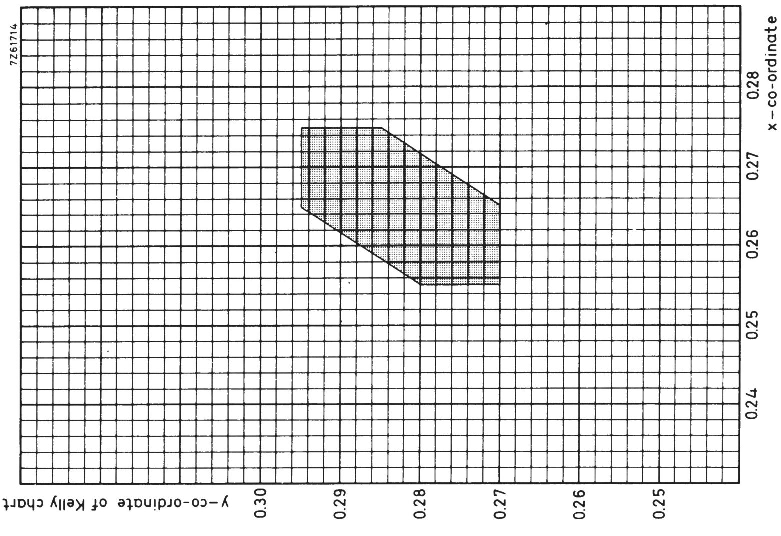


Fig. 2 Colour point tolerance area for W phosphor.

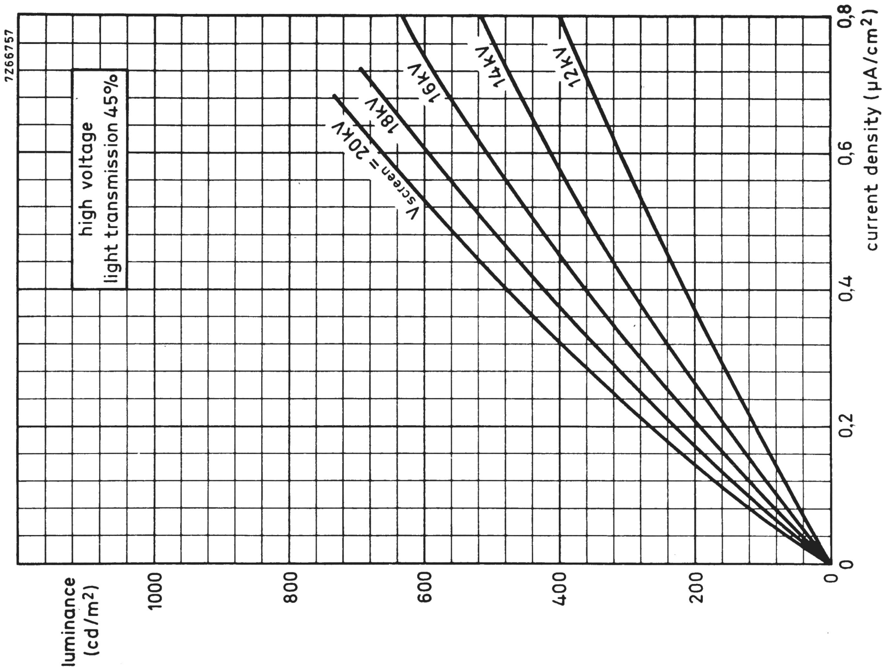


Fig. 3 Luminance as a function of current density for W phosphor.

REFERENCE LINE GAUGES

REFERENCE LINE GAUGE C (JEDEC 126) (IEC67-IV-3)

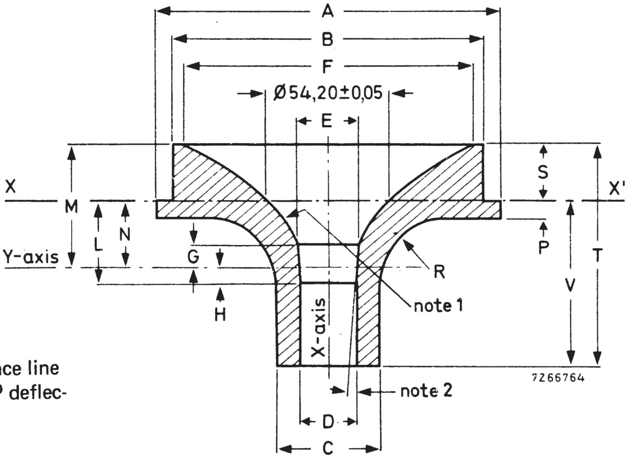


Fig. 1 Reference line gauge for 110° deflection angle.

The millimetre dimensions are derived from the original inch dimensions.

ref.	inches			millimetres			notes
	min.	nom.	max.	min.	nom.	max.	
A	–	5,000	–	–	127,00	–	–
B	–	4,500	–	–	114,30	–	–
C	–	2,000	–	–	50,80	–	–
D	1,168	1,168	1,171	29,668	29,668	29,743	–
E	1,241	1,242	1,243	31,522	31,547	31,572	–
F	4,248	4,250	4,252	107,900	107,950	108,000	–
G	–	0,279	–	–	7,09	–	2
H	–	0,250	–	–	6,35	–	–
L	1,165	1,170	1,175	29,60	29,72	29,84	2
M	–	1,634	–	–	41,50	–	–
N	–	0,920	–	–	23,37	–	1
P	–	0,250	–	–	6,35	–	–
R	–	1,000r	–	–	25,40r	–	–
S	0,712	0,714	0,716	18,085	18,136	18,186	–
T	–	3,214	–	–	81,64	–	–
V	2,490	2,500	2,510	63,25	63,50	63,75	–

Notes

1. $y = 0{,}58\,x^2 + 0{,}576$ inches ($0{,}0228\,x^2 + 14{,}630$ mm) ‘y’ values must be held to ±0,002″ (0,05 mm). The Y-axis is 0,920″ (23,368 mm) below the X-X′ reference plane.
2. 4° ± 30′ taper between planes G and L.

REFERENCE LINE GAUGE D

Dimensions in mm

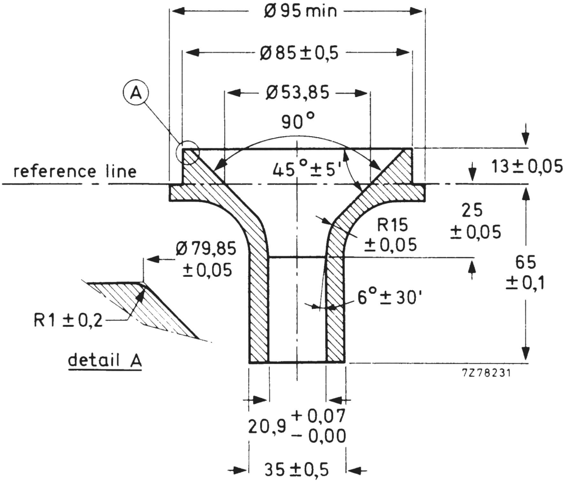

Ø95 min
Ø85 ± 0,5
Ø53,85
A
90°
reference line
45° ± 5'
13 ± 0,05
25
± 0,05
R15
± 0,05
Ø79,85
± 0,05
65
± 0,1
6° ± 30'
R1 ± 0,2
detail A
7Z78231
20,9 +0,07 −0,00
35 ± 0,5

Fig. 2 Reference line gauge for 90° deflection angle.

REFERENCE LINE GAUGE G (JEDEC G148)

Dimensions in mm

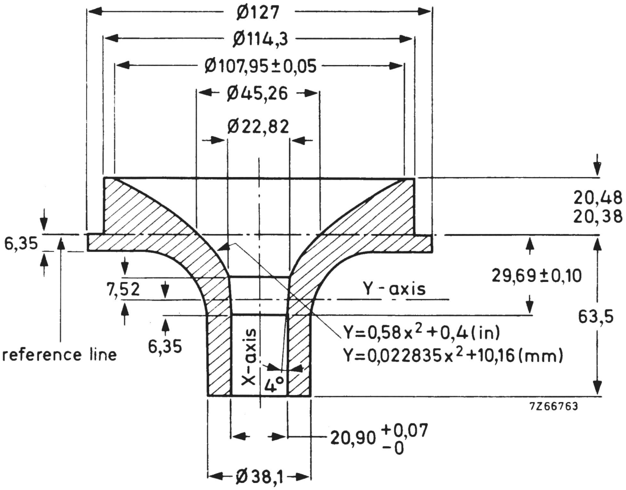

Ø127
Ø114,3
Ø107,95 ± 0,05
Ø45,26
Ø22,82
20,48
20,38
6,35
29,69 ± 0,10
7,52
Y - axis
63,5
6,35
Y=0,58x² +0,4 (in)
Y=0,022835x² +10,16 (mm)
reference line
X-axis
4°
7Z66763
20,90 +0,07 −0
Ø38,1

Fig. 3 Reference line gauge for 110° deflection angle.

Reference line gauge GR90CJ4

Dimensions in mm

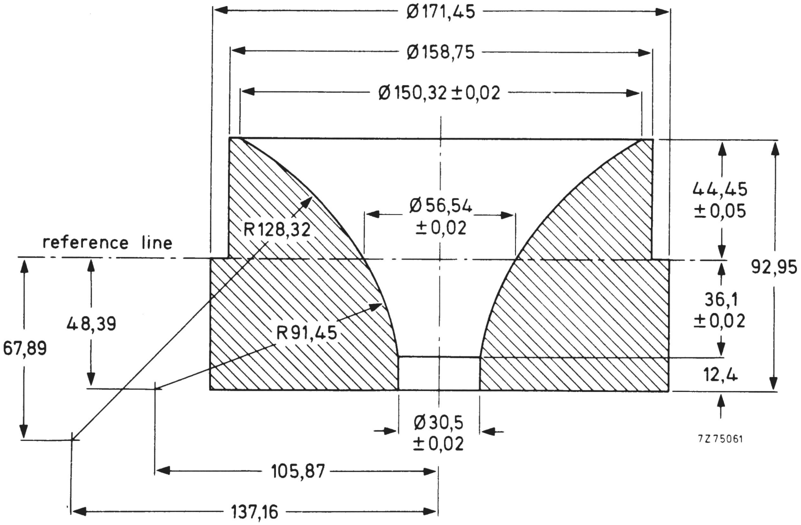

Ø171,45
Ø158,75
Ø150,32 ± 0,02
Ø56,54
± 0,02
R128,32
R91,45
reference line
44,45
± 0,05
36,1
± 0,02
92,95
12,4
48,39
67,89
Ø30,5
± 0,02
105,87
137,16
7Z75061

Fig. 4 Reference line gauge for 90° deflection angle.

BASES

SMALL-BUTTON NEO EIGHTAR BASE IEC 67-1-31
JEDEC B7-208

Dimensions in mm

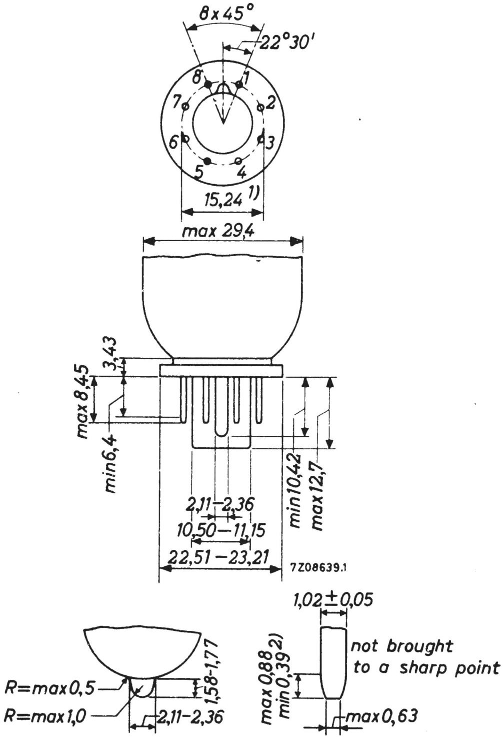

8 x 45°
22°30'
1
2
3
4
5
6
7
8
15,24 1)
max 29,4
3,43
max 8,45
min 6,4
min 10,42
max 12,7
2,11–2,36
10,50 – 11,15
22,51 – 23,21
7Z08639.1
1,02 ± 0,05
not brought
to a sharp point
max 0,88
min 0,39 2)
max 0,63
R=max 0,5
R=max 1,0
1,58-1,77
2,11–2,36

Fig. 1.

Notes

1. Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 9,53 and eight equally spaced holes of 1,40 ± 0,01 diameter located on a 15,24 ± 0,01 diameter circle. The gauge is also provided with a centre hole to provide 0,25 diametric clearance for the lug and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, pass into and disengage from the gauge.
2. This dimension may vary within the limits shown around the periphery of any individual pin.

7-PIN MINIATURE BASE WITH PUMPING STEM

Dimensions in mm

Dimensions of this base are within the JEDEC E7-91 dimensions

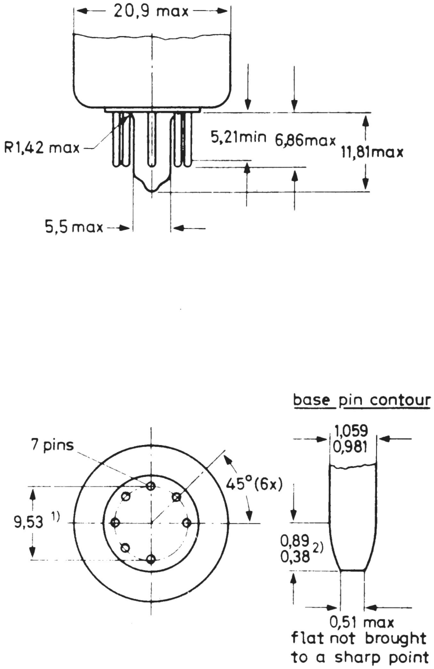

20,9 max
R1,42 max
5,21min
6,86max
11,81max
5,5 max
7 pins
45°(6x)
9,53 1)
base pin contour
1,059
0,981
0,89
0,38 2)
0,51 max
flat not brought
to a sharp point

Fig. 2.

Notes

1. Base-pin and pumping stem positions are held to tolerances such that entire length of pins and stem will without undue force pass into and disengage from a flat-plate gauge having a thickness of 6,35 mm and eight holes with diameters of 1,27 ± 0,013 mm so located on a 9,525 ± 0,013 mm diameter circle that the distance along the chord between any two adjacent hole centres is 3,645 ± 0,013 mm and a centre hole of 5,97 + 0,025 mm being chamfered at the top over 1,52 mm with an angle of 45 degrees.
2. This dimension around the periphery of any individual pin may vary within the limits shown.

12-PIN BASE IEC-67-I-47a, type 2

Dimensions in mm ←

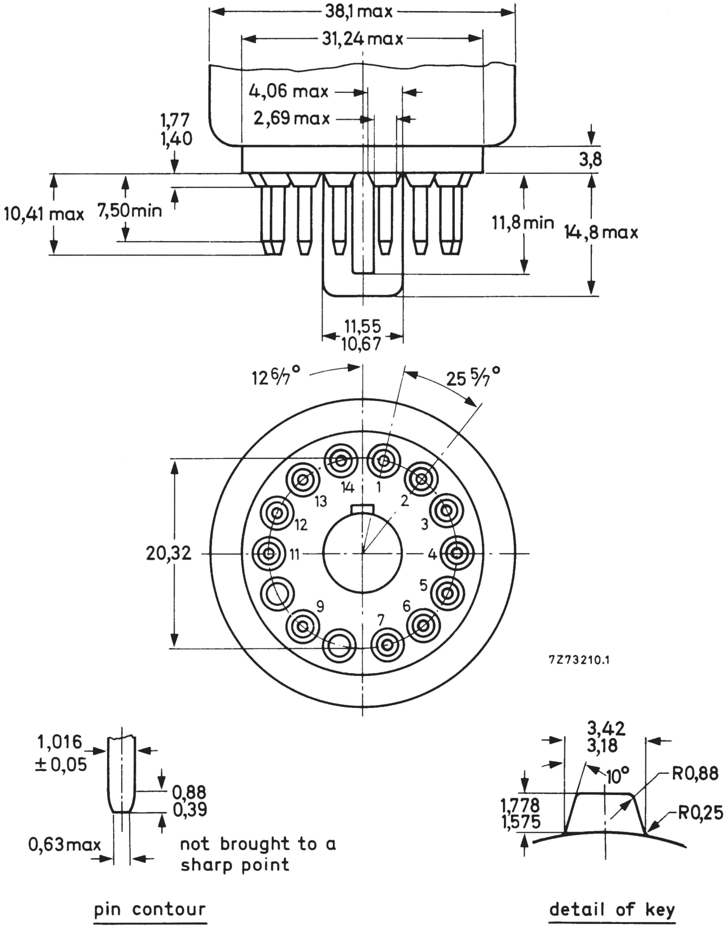
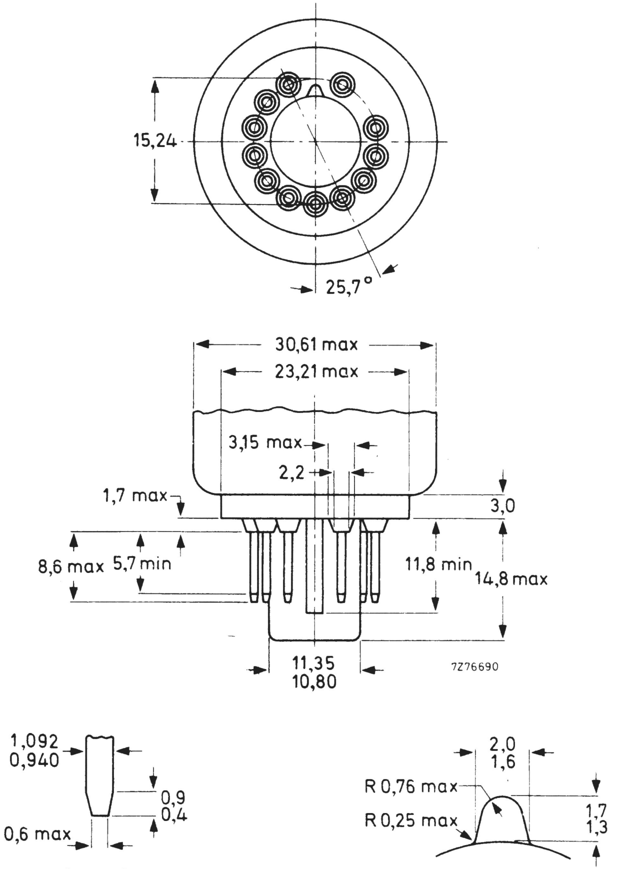

38,1 max
31,24 max
4,06 max
2,69 max
1,77
1,40
3,8
10,41 max
7,50min
11,8min
14,8 max
11,55
10,67
12 6/7°
25 5/7°
1
2
3
4
5
6
7
9
11
12
13
14
20,32
7Z73210.1
1,016
± 0,05
0,88
0,39
0,63max
not brought to a sharp point
pin contour
3,42
3,18
10°
R0,88
R0,25
1,778
1,575
detail of key

Fig. 3.

12-pin Base JEDEC B12-262


15,24
25,7°
30,61 max
23,21 max
3,15 max
2,2
1,7 max
3,0
8,6 max
5,7 min
11,8 min
14,8 max
11,35
10,80
7Z76690
1,092
0,940
0,9
0,4
0,6 max
2,0
1,6
R 0,76 max
R 0,25 max
1,7
1,3

pin contour

detail of key

Fig. 4.

COLOUR TV PICTURE TUBES B

SURVEY

90°

face diagonal	type	neck diameter mm	max. overall length mm	V_f/I_f V/mA	$V_{a,g4}$ kV	V_{g3} kV	V_{g2} V	electron gun	remarks
37 cm (14in)	A37-570X	29,1	345,1	6,3/685	25	4,7-5,5	310-560	bi-potential	
	A37-590X*	29,1	352,9	6,3/685	25	6,6-7,5	390-760	hi-bi potential	development type
42 cm (16in)	A42-570X	29,1	374,0	6,3/685	25	4,7-5,5	310-560	bi-potential	development type
	A42-590X*	29,1	384,4	6,3/685	25	6,6-7,5	390-760	hi-bi potential	development type
51 cm (20in)	A51-570X	29,1	433,5	6,3/685	25	4,7-5,5	310-560	bi-potential	
	A51-580X	29,1	441,2	6,3/685	25	6,6-7,5	390-760	hi-bi potential	
	A51-590X*	29,1	441,2	6,3/685	25	6,6-7,5	390-760	hi-bi potential	development type

* With appropriate deflection unit it forms a self converging and raster correction free assembly.

110°

face diagonal	type	neck diameter mm	max. overall length mm	V_f/I_f V/mA	$V_{a,g4}$ kV	V_{g3} kV	V_{g2} V	electron gun	remarks
51 cm (20in)	A51-540X	36,5	367,4	6,3/720	25	6,5-7,45	590-800	hi-bi potential	
56 cm (22in)	A56-540X	36,5	389,8	6,3/720	25	6,5-7,45	590-800	hi-bi potential	
66 cm (26in)	A66-540X	36,5	427,6	6,3/720	25	6,5-7,45	590-800	hi-bi potential	

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic bi-potential focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphor featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Tension band implosion protection; push through
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1200 or AT1205), it forms a self-converging assembly; dynamic convergence is not required.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	37 cm
Overall length	340 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	20% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	bi-potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 1600 pF min. 800 pF
grid 1 to all other electrodes	C_{g1}	15 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	polished
Useful screen dimensions	
diagonal	min. 335,4 mm
horizontal axis	min. 280,8 mm
vertical axis	min. 210,6 mm
area	min. 580 cm²
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,65 mm
Light transmission of face glass at centre	68%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	340,1 ± 5 mm
Neck diameter	$29{,}1^{+1{,}4}_{-0{,}7}$ mm *
Bulb dimensions	
diagonal	max. 368 mm
width	max. 317 mm
height	max. 248 mm
Base	12-pin base JEDEC B12-262
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 6 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

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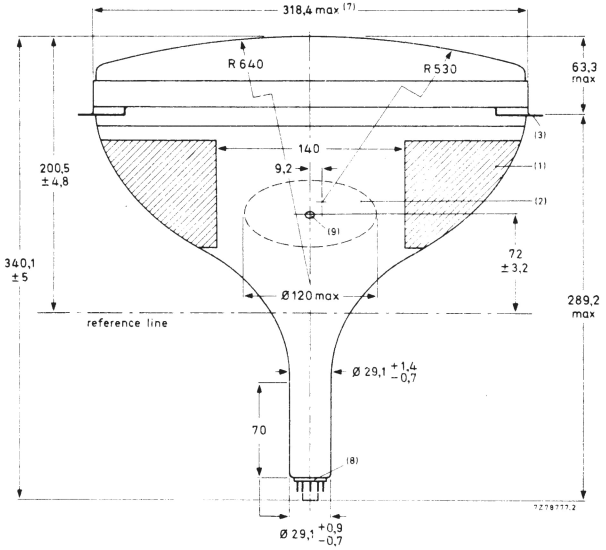
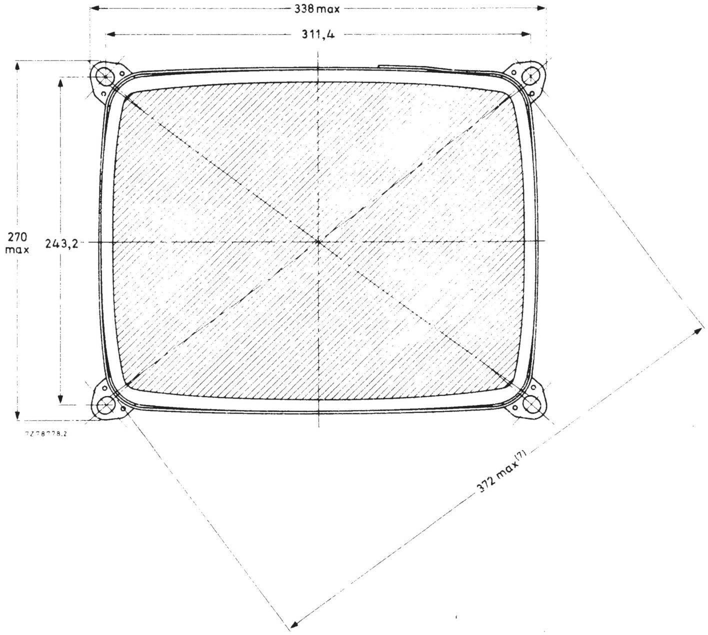
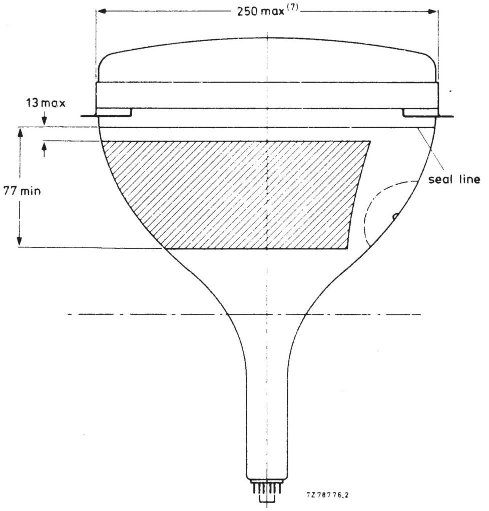
* In the region of 70 mm from the neck end, the maximum diameter is 30 mm.

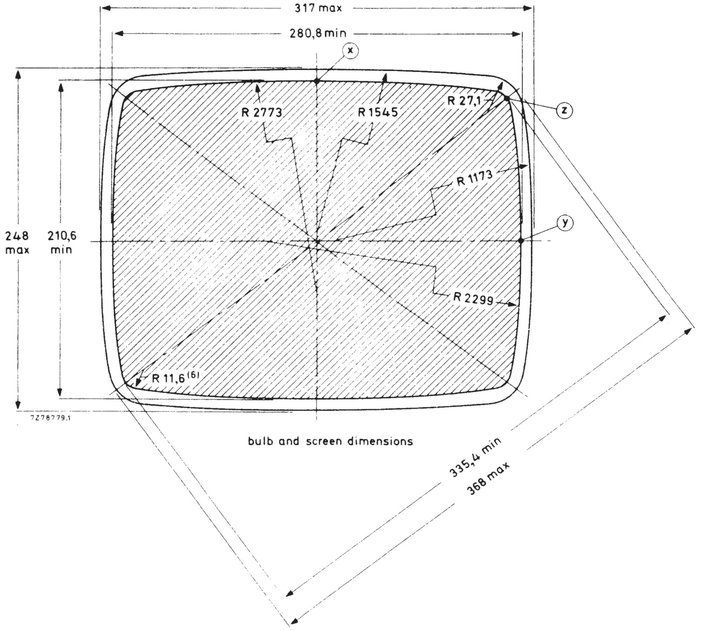
MECHANICAL DATA (continued) Dimensions in mm

Notes are given after the drawings.


318,4 max (7)
R 640
R 530
63,3 max
(3)
140
9,2
(1)
(2)
(9)
200,5 ± 4,8
340,1 ± 5
72 ± 3,2
Ø 120 max
289,2 max
reference line
Ø 29,1 +1,4 −0,7
70
(8)
Ø 29,1 +0,9 −0,7
7Z78777.2

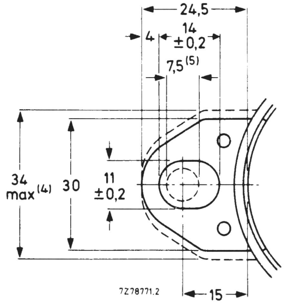

338 max
311,4
270 max
243,2
7Z78778.2
372 max (7)

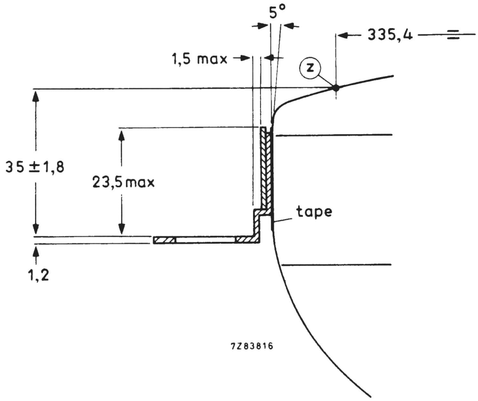

250 max (7)
13 max
77 min
seal line
7Z78776.2

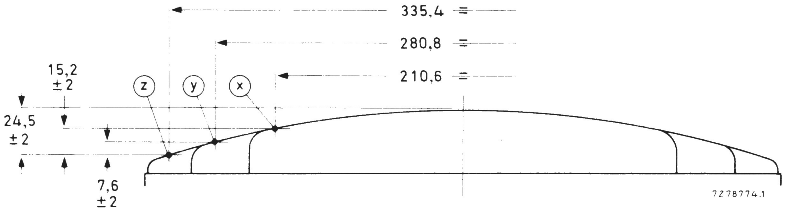

317 max
280,8 min
x
R 2773
R 1545
R 27,1
z
R 1173
y
248 max
210,6 min
R 2299
R 11,6 (6)
7Z78779.1
335,4 min
368 max

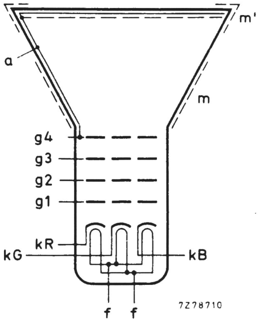
bulb and screen dimensions

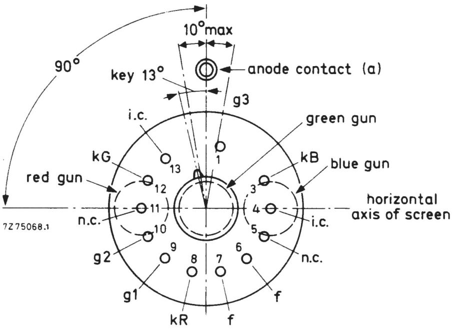
MECHANICAL DATA (continued)


24,5
4
14
±0,2
7,5(5)
34
max(4)
30
11
±0,2
15
7Z78771.2


5°
335,4
1,5 max
z
35 ± 1,8
23,5 max
tape
1,2
7Z83816


335,4
280,8
210,6
15,2
± 2
24,5
± 2
7,6
± 2
z
y
x
7Z78774.1


m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

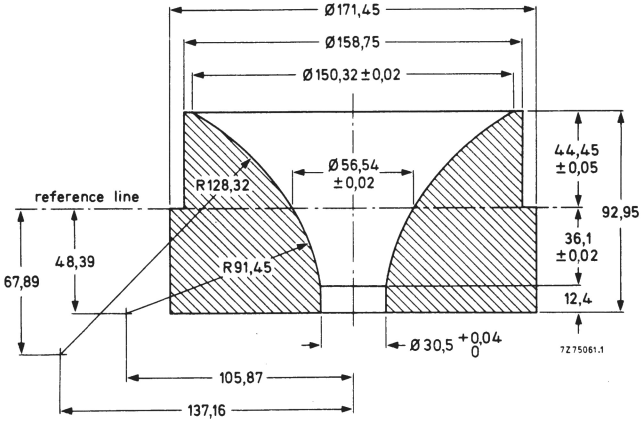

10° max
90°
key 13°
anode contact (a)
g3
i.c.
green gun
kG
kB
blue gun
red gun
horizontal
axis of screen
1
13
12
3
11
4
n.c.
i.c.
10
5
9
6
8
7
g2
n.c.
g1
f
kR
f
7Z75068.1

i.c. = internally connected (not to be used)
n.c. = not connected

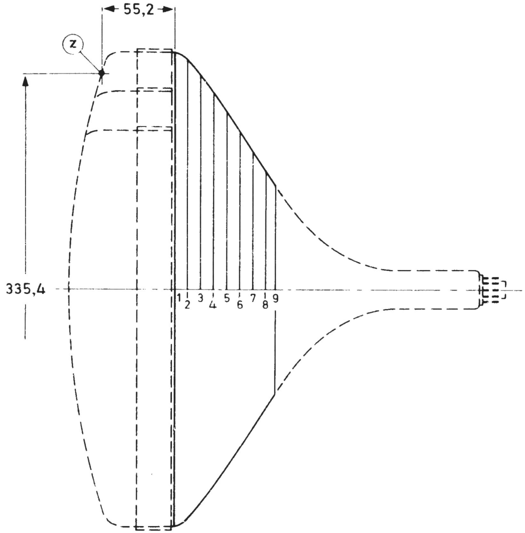
Notes to outline drawings on the preceding pages

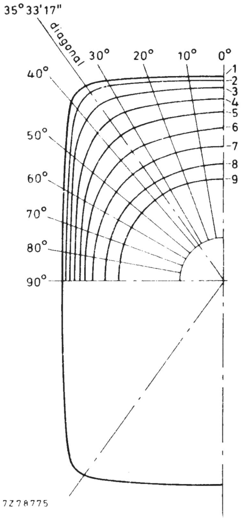
1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 7,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 311,4 mm x 243,2 mm.
6. Co-ordinates for radius R = 11,6 mm: x = 126,98 mm, y = 90,76 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC 67-III-2,

Reference line gauge; GR90CJ4


Ø171,45
Ø158,75
Ø150,32 ±0,02
Ø56,54 ±0,02
R128,32
R91,45
reference line
48,39
67,89
44,45 ±0,05
92,95
36,1 ±0,02
12,4
Ø30,5 +0,04 0
105,87
137,16
7Z75061.1

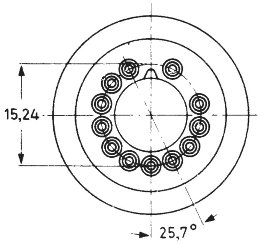
Maximum cone contour

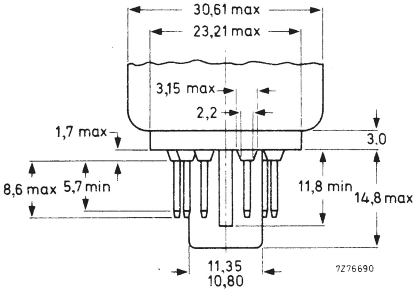


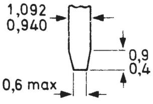


section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30′	diag. axes	37° 30′	40°	45°	50°	60°	70°	80°	90°
1	0	157,2	159,4	166,3	171,7	178,2	181,2	183,6	183,3	180,0	167,9	156,5	140,0	129,8	124,2	122,4
2	10	154,7	156,9	163,5	168,5	174,1	176,6	178,1	177,7	174,8	164,4	153,7	137,8	127,9	122,4	120,7
3	20	148,8	150,7	156,3	160,0	163,5	164,6	165,0	164,4	162,6	156,0	147,7	133,6	124,4	119,3	117,7
4	30	140,4	142,1	146,2	148,6	150,5	151,0	151,1	150,7	149,6	145,6	140,0	128,6	120,3	115,7	114,2
5	40	130,3	131,3	134,0	135,4	136,5	136,8	136,8	136,6	136,1	134,1	130,8	122,7	115,9	111,7	110,3
6	50	118,2	118,8	120,1	120,9	121,6	121,8	122,0	122,0	121,9	121,2	119,8	115,4	110,5	107,0	105,8
7	60	104,9	104,7	105,1	105,5	106,0	106,2	106,5	106,7	106,9	107,1	107,0	105,6	103,1	100,8	99,8
8	70	90,6	89,9	89,8	90,0	90,4	90,6	90,9	91,1	91,4	91,9	92,3	92,5	91,7	90,4	89,7
9	77	79,9	79,1	79,0	79,1	79,4	79,6	79,9	80,1	80,4	80,9	81,4	81,8	81,4	80,5	79,9

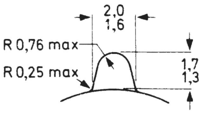
12-pin base; JEDEC B12-262




30,61 max
23,21 max
3,15 max
2,2
1,7 max
3,0
8,6 max
5,7 min
11,8 min
14,8 max
11,35
10,80
7Z76690


1,092
0,940
0,9
0,4
0,6 max

pin contour


2,0
1,6
R 0,76 max
R 0,25 max
1,7
1,3

detail of key

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,7 to 5,5	kV
Grid 2 voltage for a spot cut-off voltage V_k = 120 V	V_{g2}	310 to 560	V
Luminance at the centre of the screen *	L	175	cd/m^2

---

* Tube settings adjusted to produce white of 6500K + 7 M.P.C.D. (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	18,8 to 22% of anode voltage	
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart *	
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value	
Video drive characteristics		see graphs **	
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA	
Grid 2 current	I_{g2}	−5 to + 5 μA	
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 μA	
To produce white of 6500K + 7 M.P.C.D. (CIE co-ordinates x = 0,313, y = 0,329)			
Percentage of the total anode current supplied by each gun (typical)			
red gun		38,3%	
green gun		35,8%	
blue gun		25,9%	
Ratio of anode currents			
red gun to green gun		min.	0,7
		average	1,1
		max.	1,4
red gun to blue gun		min.	1,1
		average	1,5
		max.	2,0
blue gun to green gun		min.	0,5
		average	0,7
		max.	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 120 V. Increase the V_{g2} from about 300 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	max. min.	27,5 kV 20 kV	notes 1, 2, 3 notes 1 and 4
Long-term average current for three guns	I_a	max.	750 μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	7 kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000 V	
Cathode voltage				
positive	V_k	max.	400 V	
positive operating cut-off	V_k	max.	200 V	
negative	$-V_k$	max.	0 V	
negative peak	$-V_{kp}$	max.	2 V	
Heater voltage	V_f	max. min.	7,2 V 5,4 V	note 6
Heater-cathode voltage				
heater negative with respect to cathode				
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450 V	note 1
after equipment warm-up period	V_{kf}	max.	250 V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200 V	note 1
	$-V_{kf}$	max.	0 V (d.c. component value)	

Notes
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1000 μA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

FLASHOVER PROTECTION

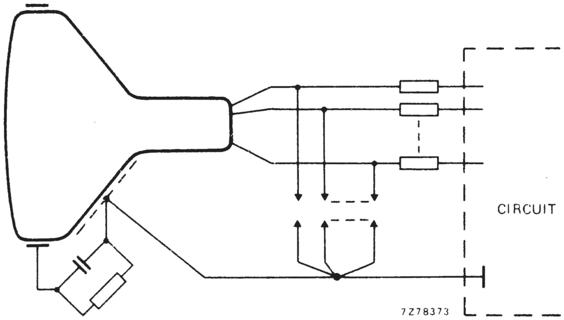
With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.

The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 8,5 kV (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.

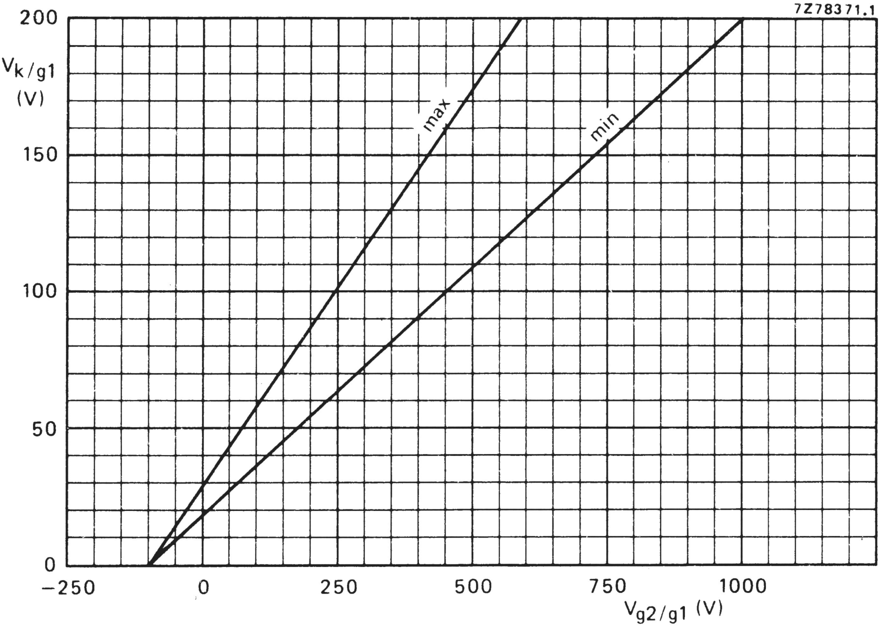
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.

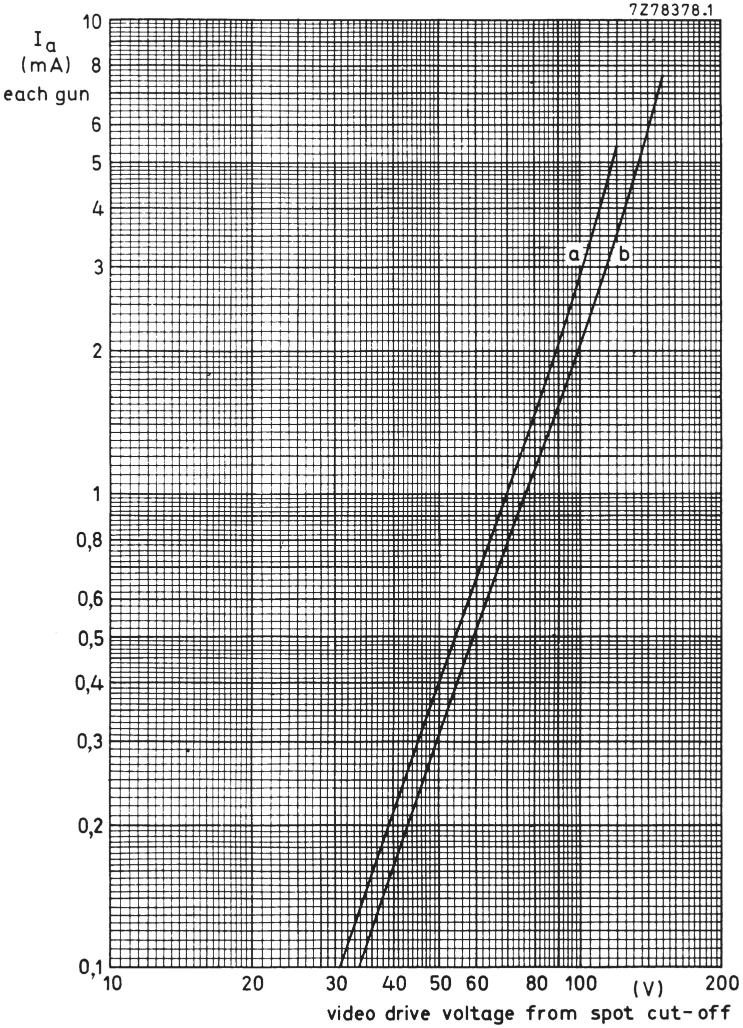


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	4 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm



Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.



Typical cathode drive characteristics.

V_f = 6,3 V;

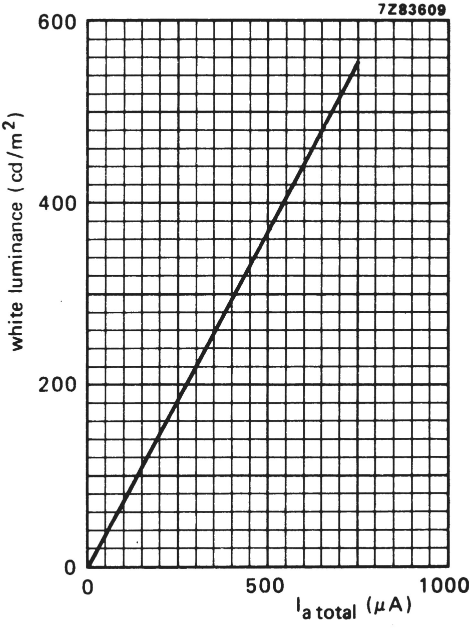
$V_{a,g4}$ = 25 kV;

V_{g3} adjusted for focus;

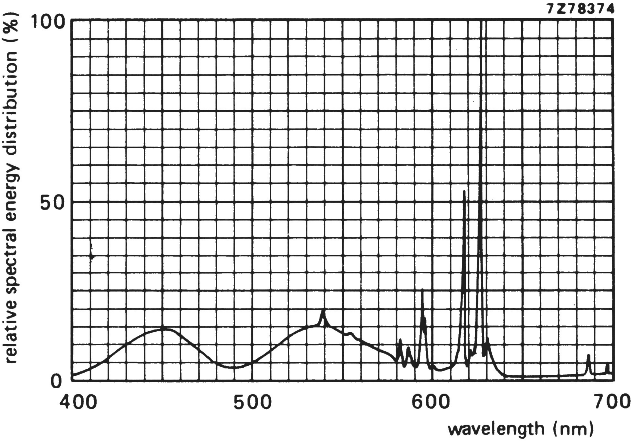
V_{g2} adjusted to provide spot cut-off for desired fixed V_k.

curve a = spot cut-off = 120 V;

curve b = spot cut-off = 150 V.

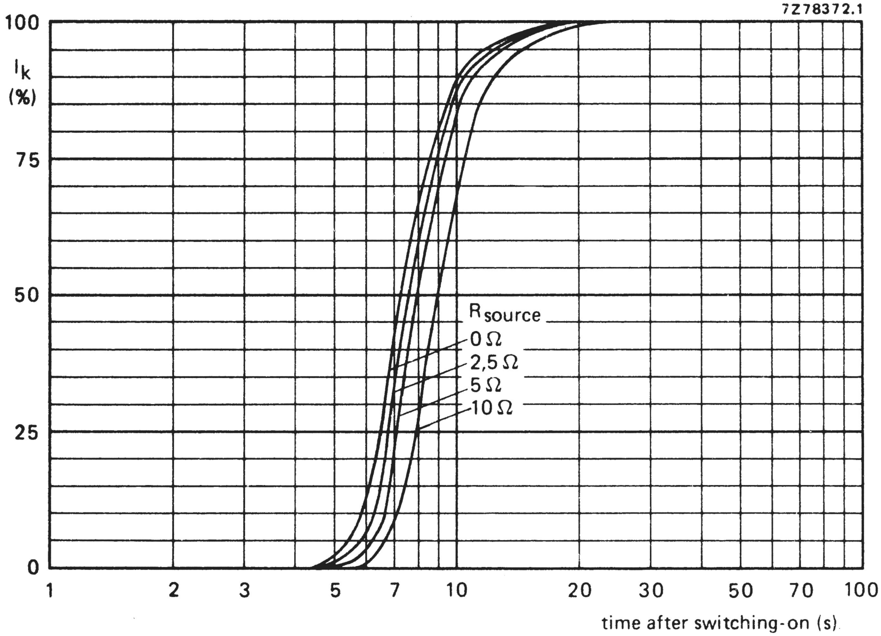


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV, V_f = 6,3 V, V_{g3} adjusted for optimum focus.
Scanned area = 280,8 mm x 210,6 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

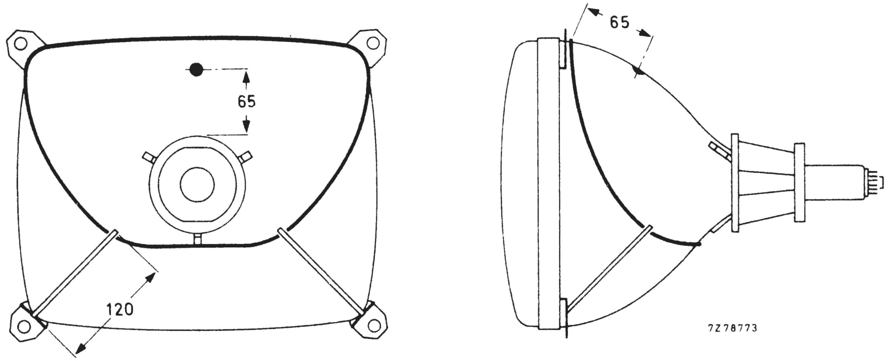
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



Cathode heating time after switching on, measured under typical operating conditions.

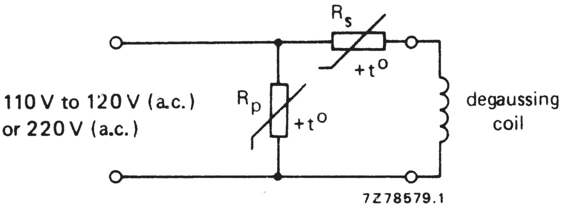
DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of one magnetic coil winding mounted on the cone of the picture tube.



Position of degaussing coil on the picture tube; dimensions are given in mm.

For proper degaussing an initial magnetomotive force (m.m.f.) of 600 ampere-turns is required in the coil. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coil (⩽ 0,6 ampere-turns). If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents. An example of a degaussing circuit and coil data for various mains voltages are given below.



Degaussing circuit using dual PTC thermistor.

Data of degaussing coil

	110 V (a.c.) mains	220 V (a.c.) mains
Circumference	90 cm	90 cm
Number of turns	70	120
Copper-wire diameter	0,45 mm	0,3 mm
Resistance	6,7 Ω	25,9 Ω
Catalogue number of appropriate dual PTC thermistor	8222 298 73091	2322 662 98009

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic hi-bi-potential focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphor featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Reinforced envelope for push-through mounting
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1206), it forms a self-converging and raster correction free assembly.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	37 cm
Overall length	348 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	hi-bi-potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 1600 pF min. 800 pF
grid 1 to all other electrodes	C_{g1}	17 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 335,4 mm
horizontal axis	min. 280,8 mm
vertical axis	min. 210,6 mm
area	min. 580 cm²
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,65 mm
Light transmission of face glass at centre	68%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	347,9 ± 5 mm
Neck diameter	$29,1\,^{+1,4}_{-0,7}$ mm *
Bulb dimensions	
diagonal	max. 368 mm
width	max. 317 mm
height	max. 248 mm
Base	10-pin base JEDEC B10-277
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 6 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

DEVELOPMENT SAMPLE DATA

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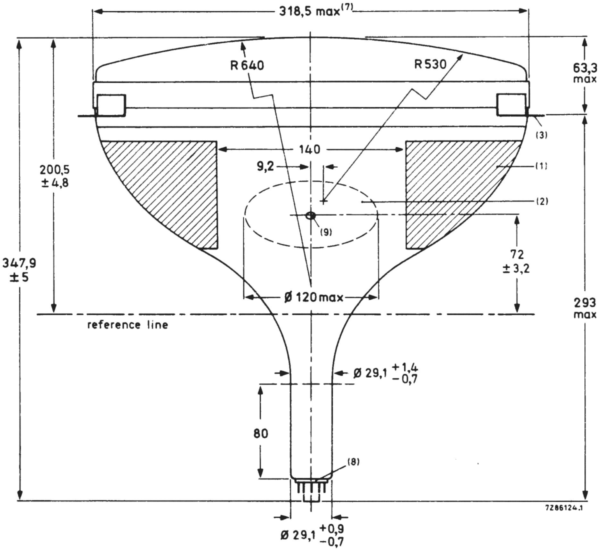
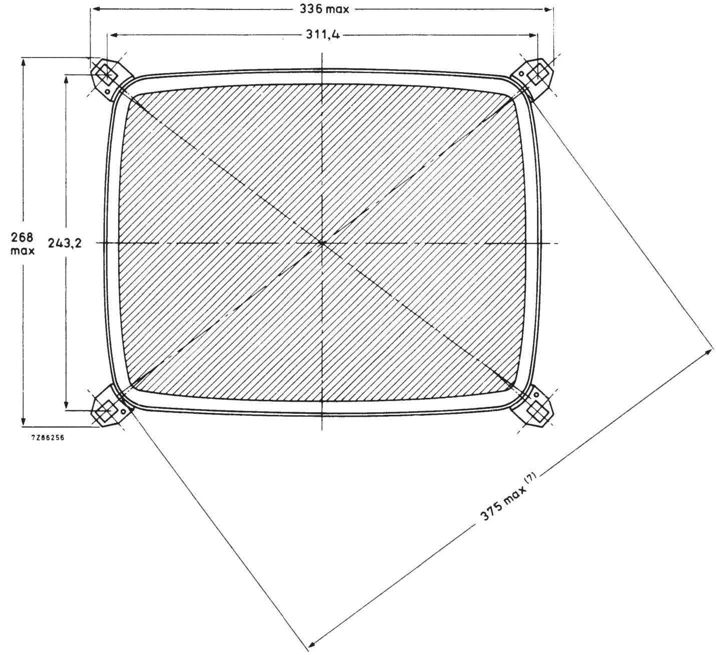
* In the region of 80 mm from the neck end, the maximum diameter is 30 mm.

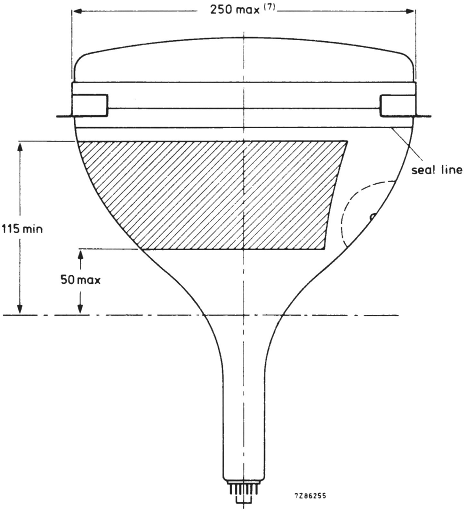
MECHANICAL DATA (continued)

Dimensions in mm

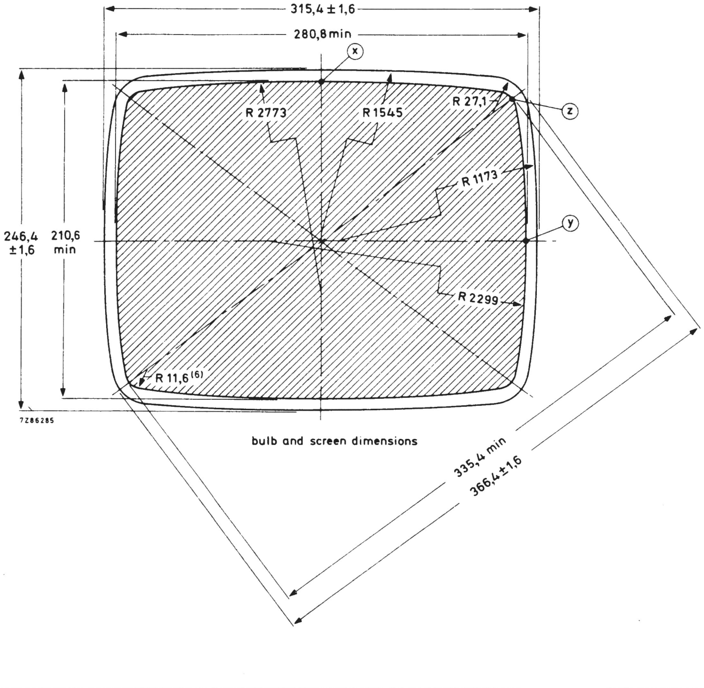
Notes are given after the drawings.


318,5 max(7)
R 640
R 530
63,3 max
(3)
140
9,2
(1)
(2)
(9)
200,5 ±4,8
347,9 ±5
72 ±3,2
293 max
Ø 120 max
reference line
Ø 29,1 +1,4 −0,7
80
(8)
7Z86124.1
Ø 29,1 +0,9 −0,7

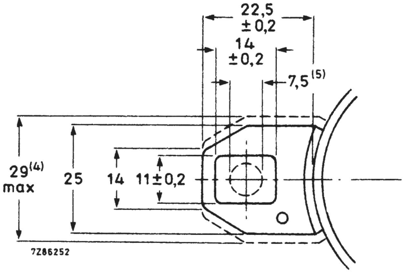

336 max
311,4
268 max
243,2
7Z86256
375 max (7)

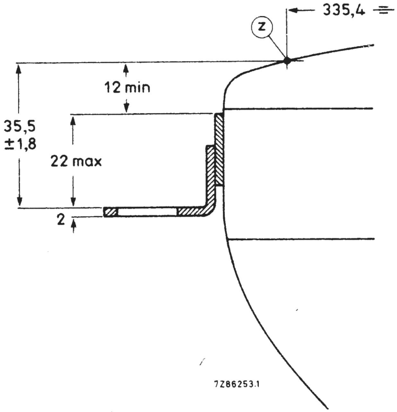

250 max (7)
seal line
115 min
50 max
7Z86255

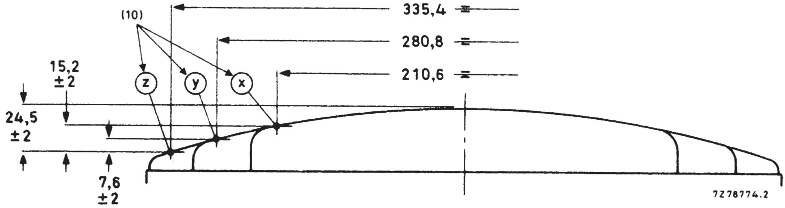
DEVELOPMENT SAMPLE DATA

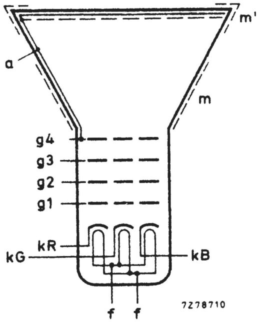

315,4 ± 1,6
280,8 min
x
z
y
R 2773
R 1545
R 27,1
R 1173
R 2299
R 11,6 (6)
246,4 ±1,6
210,6 min
7Z86285
335,4 min
366,4 ± 1,6

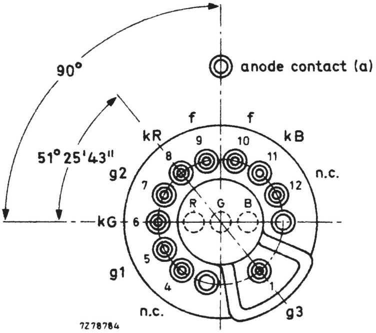
bulb and screen dimensions


22,5
±0,2
14
±0,2
7,5 (5)
29 (4)
max
25
14
11±0,2
7Z86252


z
335,4
12 min
35,5
±1,8
22 max
2
7Z86253.1


(10)
335,4
280,8
210,6
z
y
x
15,2
±2
24,5
±2
7,6
±2
7Z78774.2


m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

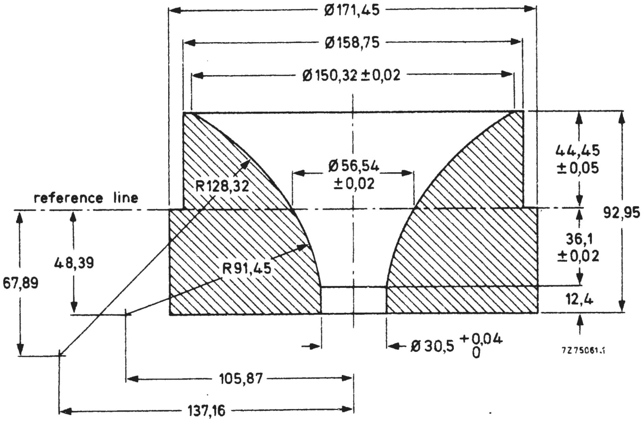

90°
anode contact (a)
51°25'43"
f
f
kR
kB
9
10
8
11
g2
n.c.
7
12
R
G
B
kG
6
5
g1
4
1
n.c.
g3
7Z78784

Notes to outline drawings on the preceding pages

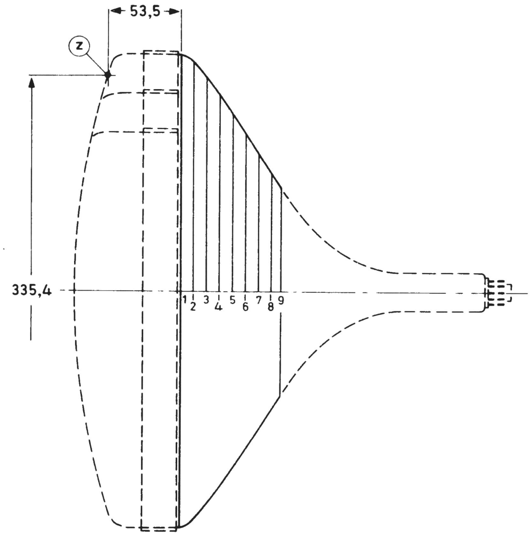
1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. One of the four mounting lugs may deviate (1,0 mm max.) from the plane of the other three lugs. This deviation is incorporated in the tolerance of ± 1,8 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 7,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 311,4 mm x 243,2 mm.
6. Co-ordinates for radius R = 11,6 mm: x = 126,98 mm, y = 90,76 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.

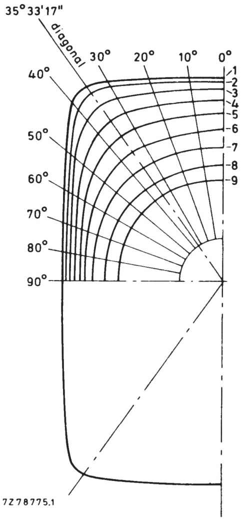
DEVELOPMENT SAMPLE DATA

Reference line gauge; GR90CJ4



Maximum cone contour

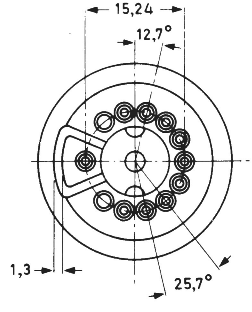


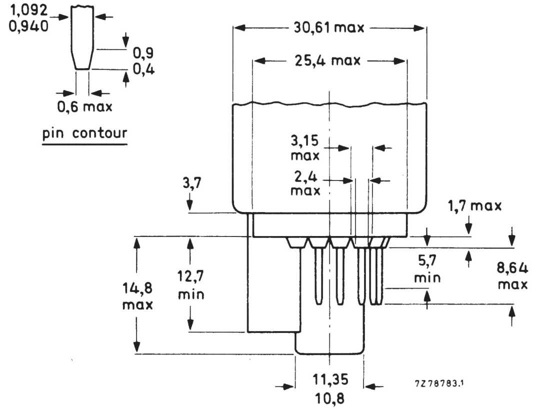


section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30′	diag. axes	37° 30′	40°	45°	50°	60°	70°	80°	90°
1	0	157,2	159,4	166,3	171,7	178,2	181,2	183,6	183,3	180,0	167,9	156,5	140,0	129,8	124,2	122,4
2	10	154,7	156,9	163,5	168,5	174,1	176,6	178,1	177,7	174,8	164,4	153,7	137,8	127,9	122,4	120,7
3	20	148,8	150,7	156,3	160,0	163,5	164,6	165,0	164,4	162,6	156,0	147,7	133,6	124,4	119,3	117,7
4	30	140,4	142,1	146,2	148,6	150,5	151,0	151,1	150,7	149,6	145,6	140,0	128,6	120,3	115,7	114,2
5	40	130,3	131,3	134,0	135,4	136,5	136,8	136,8	136,6	136,1	134,1	130,8	122,7	115,9	111,7	110,3
6	50	118,2	118,8	120,1	120,9	121,6	121,8	122,0	122,0	121,9	121,2	119,8	115,4	110,5	107,0	105,8
7	60	104,9	104,7	105,1	105,5	106,0	106,2	106,5	106,7	106,9	107,1	107,0	105,6	103,1	100,8	99,8
8	70	90,6	89,9	89,8	90,0	90,4	90,6	90,9	91,1	91,4	91,9	92,3	92,5	91,7	90,4	89,7
9	77	79,9	79,1	79,0	79,1	79,4	79,6	79,9	80,1	80,4	80,9	81,4	81,8	81,4	80,5	79,9

DEVELOPMENT SAMPLE DATA

10-pin base; JEDEC B10-277


15,24
12,7°
1,3
25,7°


1,092
0,940
0,9
0,4
0,6 max
pin contour
30,61 max
25,4 max
3,15 max
2,4 max
3,7
1,7 max
5,7 min
8,64 max
14,8 max
12,7 min
11,35
10,8
7Z78783.1

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,6 to 7,5	kV
Grid 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	390 to 760	V
Luminance at the centre of the screen*	L	175	cd/m^2

---

* Tube settings adjusted to produce white of 6500K + 7 M.P.C.D. (x = 0,313, y = 0,329) focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26,6 to 29,8% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart *
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs **
Grid 3 (focusing electrode) current	I_{g3}	–5 to + 5 μA
Grid 2 current	I_{g2}	–5 to + 5 μA
Grid 1 current under cut-off conditions	I_{g1}	–5 to + 5 μA

To produce white of 6500K + 7 M.P.C.D.
(CIE co-ordinates x = 0,313, y = 0,329)

Percentage of the total anode current supplied by each gun (typical)

red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode currents

red gun to green gun	min.	0,7
	average	1,1
	max.	1,4
red gun to blue gun	min.	1,1
	average	1,5
	max.	2,0
blue gun to green gun	min.	0,5
	average	0,7
	max.	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 140 V. Increase the V_{g2} from about 400 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	max.	27,5	kV	notes 1, 2, 3
		min.	20	kV	notes 1 and 4
Long-term average current for three guns	I_a	max.	750	µA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	11	kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000	V	
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Heater voltage	V_f	max.	7,2	V	note 6
		min.	5,4	V	
Heater-cathode voltage					
heater negative with respect to cathode					
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450	V	note 1
after equipment warm-up period	V_{kf}	max.	250	V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200	V	note 1
	$-V_{kf}$	max.	0	V	
		(d.c. component value)			

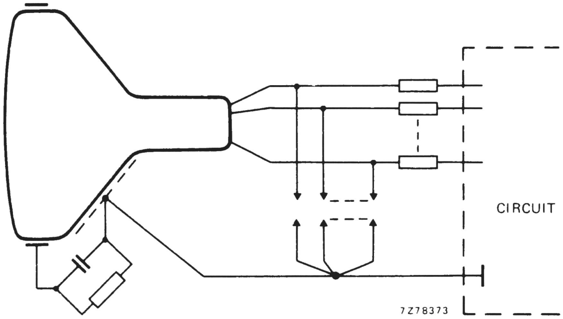
DEVELOPMENT SAMPLE DATA

Notes

1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1000 µA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

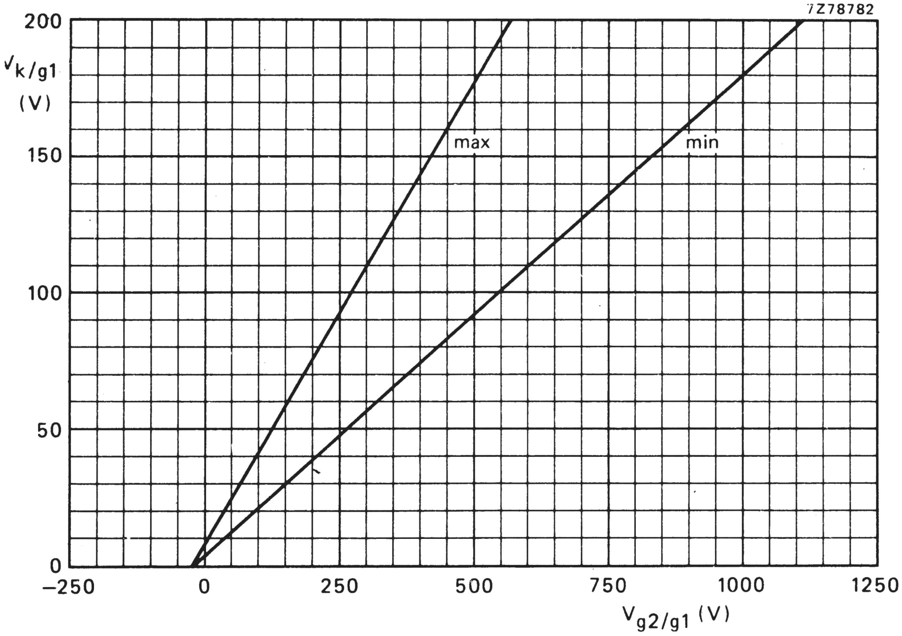
FLASHOVER PROTECTION

With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.
The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 11 kV (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.
Additional information is available on request.

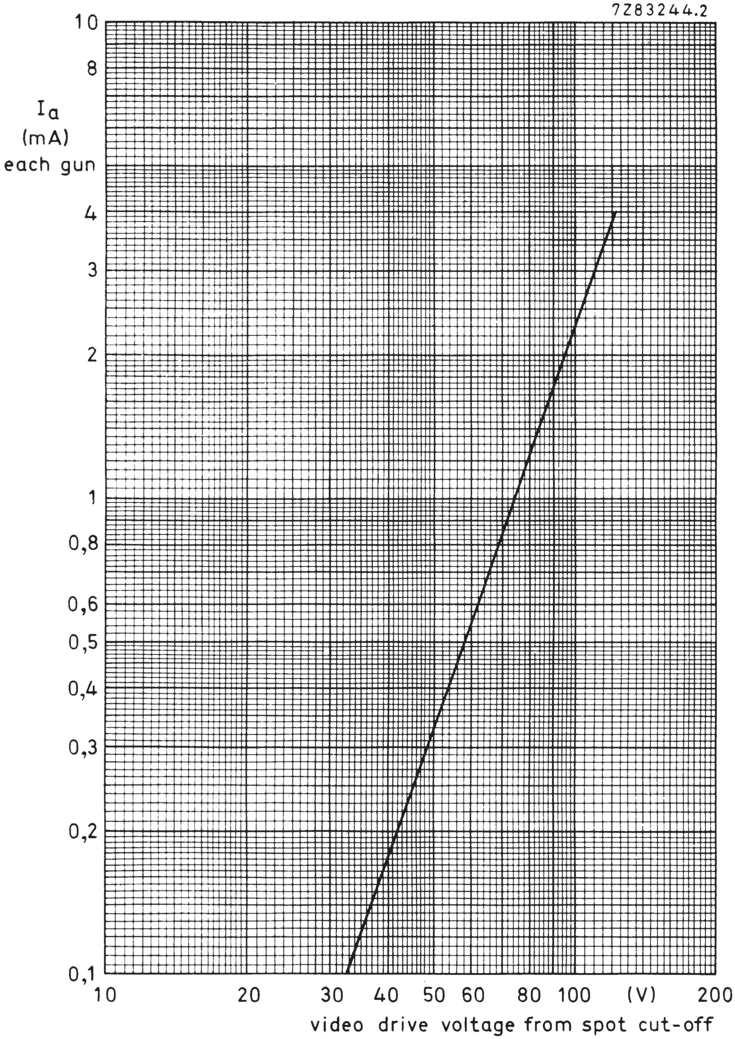


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	4 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm



Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV,



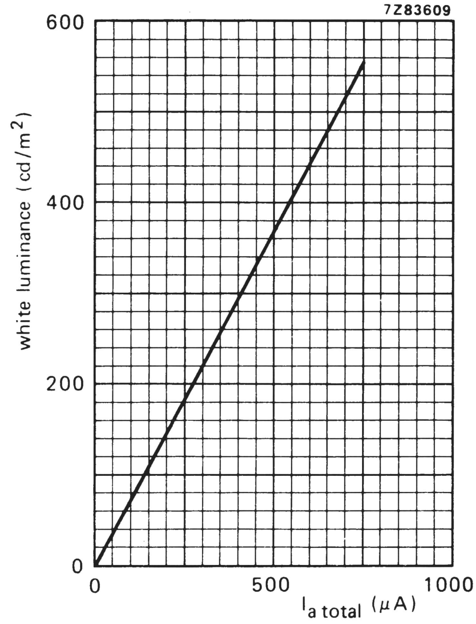
Typical cathode drive characteristics.

V_f = 6,3 V;

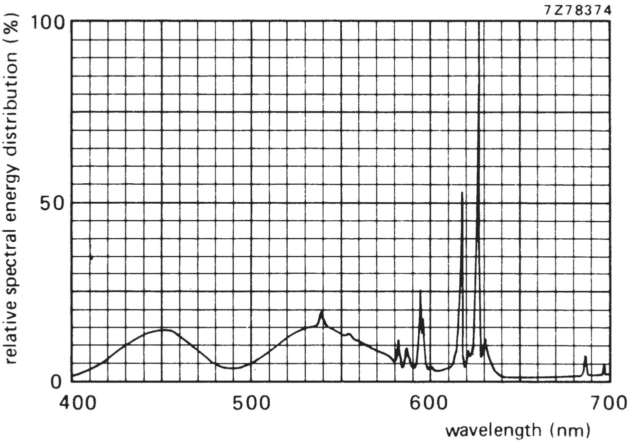
$V_{a,g4}$ = 25 kV;

V_{g3} adjusted for focus;

V_{g2} adjusted to provide spot cut-off for V_K = 140 V.

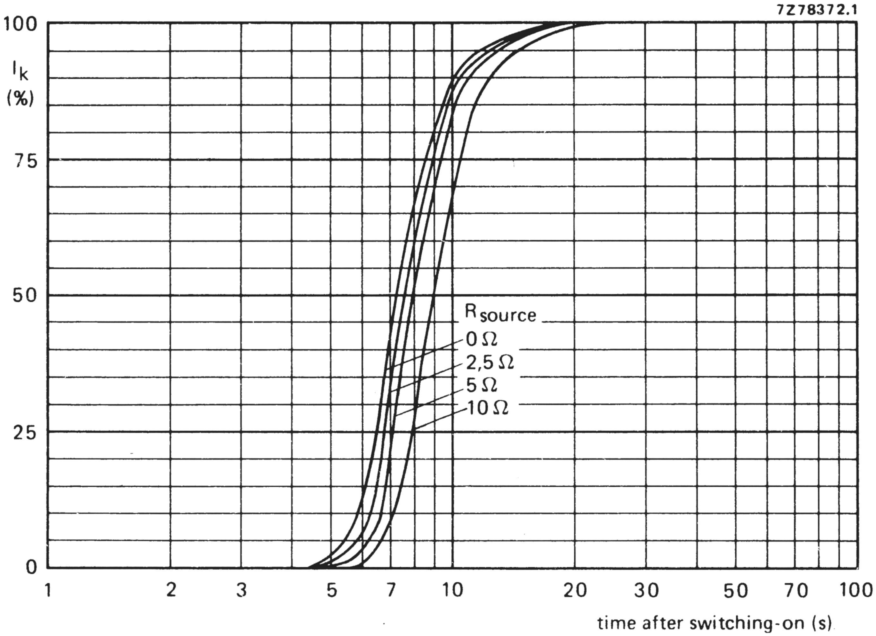


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV, V_f = 6,3 V, V_{g3} adjusted for optimum focus.
Scanned area = 280,8 mm x 210,6 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

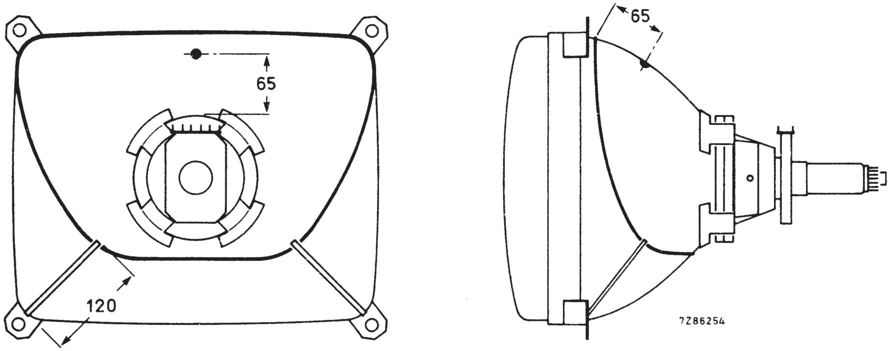
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



Cathode heating time after switching on, measured under typical operating conditions.

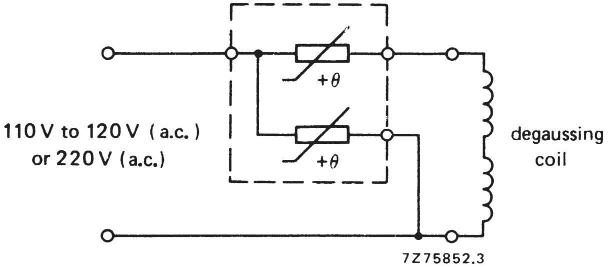
DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of one magnetic coil winding mounted on the cone of the picture tube.



Position of degaussing coil on the picture tube; dimensions are given in mm.

For proper degaussing an initial magnetomotive force (m.m.f.) of 600 ampere-turns is required in the coil. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coil (≤ 0,6 ampere-turns). If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents. An example of a degaussing circuit and coil data for various mains voltages are given below.



Degaussing circuit using dual PTC thermistor.

Data of degaussing coil

	110 V (a.c.) mains	220 V (a.c.) mains
Circumference	90 cm	90 cm
Number of turns	70	120
Copper-wire diameter	0,45 mm	0,3 mm
Resistance	6,7 Ω	25,9 Ω
Catalogue number of appropriate dual PTC thermistor	8222 298 73091	2322 662 98009

This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic bi-potential focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphor featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Tension band implosion protection; push through
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1215, it forms a self-converging assembly; dynamic convergence is not required.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	42 cm
Overall length	369 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	20% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	bi-potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 1600 pF min. 1000 pF
grid 1 to all other electrodes	C_{g1}	15 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	polished
Useful screen dimensions	
diagonal	min. 382,3 mm
horizontal axis	min. 322,1 mm
vertical axis	min. 241,6 mm
area	min. 755 cm^2
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,70 mm
Light transmission of face glass at centre	68%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	369 ± 5 mm
Neck diameter	$29{,}1\,^{+1{,}4}_{-0{,}7}$ mm *
Bulb dimensions	
diagonal	max. 418,8 mm
width	max. 360,6 mm
height	max. 281,6 mm
Base	12-pin base JEDEC B12-262
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 8 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

DEVELOPMENT SAMPLE DATA

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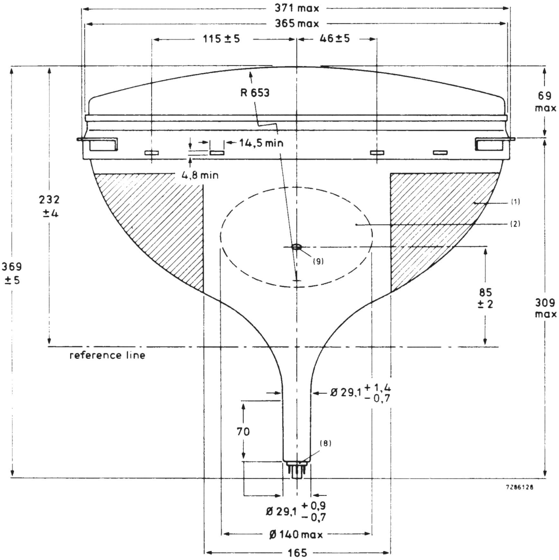
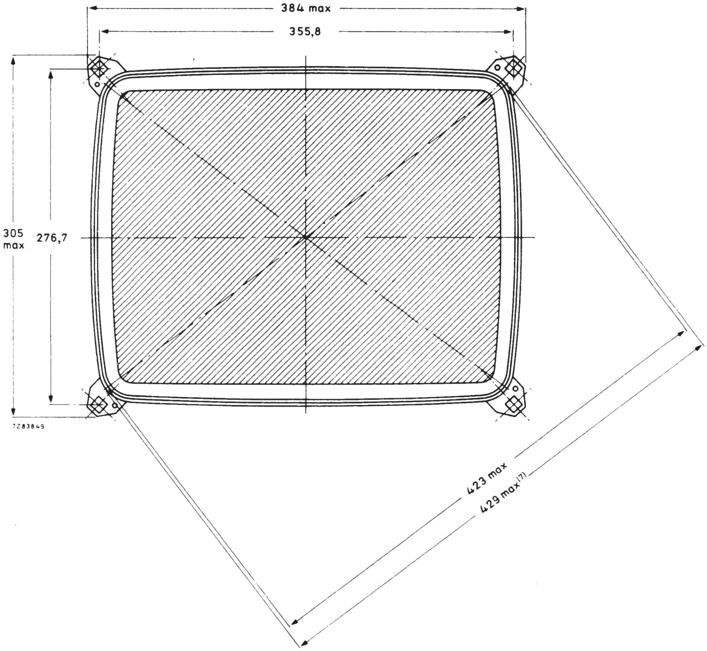
* In the region of 70 mm from the neck end, the maximum diameter is 30 mm.

MECHANICAL DATA (continued)

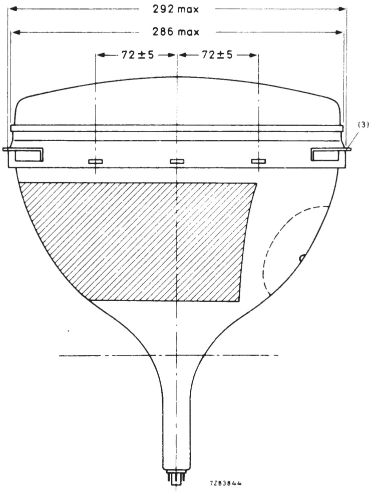
Dimensions in mm

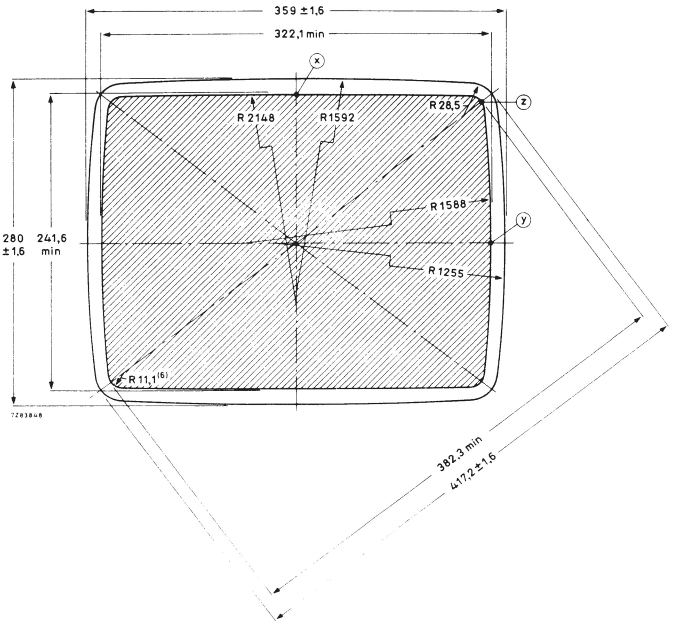
Notes are given after the drawings.


371 max
365 max
115 ± 5
46 ± 5
R 653
69 max
14,5 min
4,8 min
232 ±4
369 ±5
(1)
(2)
(9)
85 ±2
309 max
reference line
Ø 29,1 +1,4 −0,7
70
(8)
7Z86128
Ø 29,1 +0,9 −0,7
Ø 140 max
165

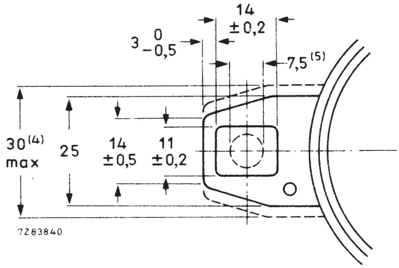

384 max
355,8
305 max
276,7
7Z83849
423 max
429 max(7)

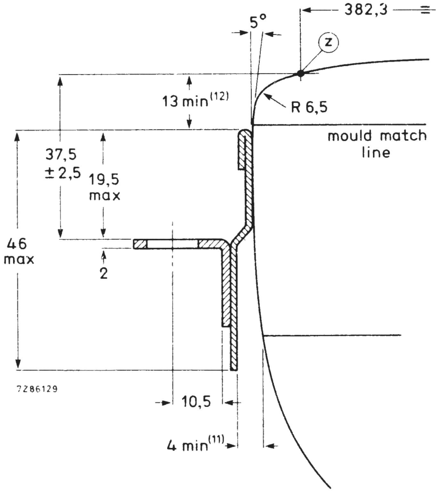
DEVELOPMENT SAMPLE DATA

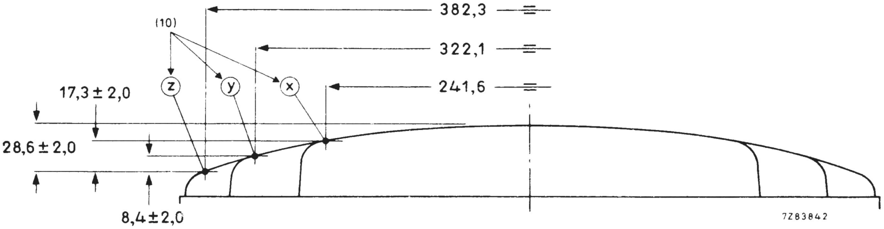

292 max
286 max
72 ± 5
72 ± 5
(3)
7Z83844

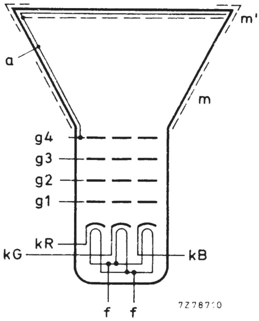

359 ± 1,6
322,1 min
x
R 2148
R 1592
R 28,5
z
R 1588
y
R 1255
280
± 1,6
241,6
min
R 11,1(6)
7Z83848
382,3 min
417,2 ± 1,6

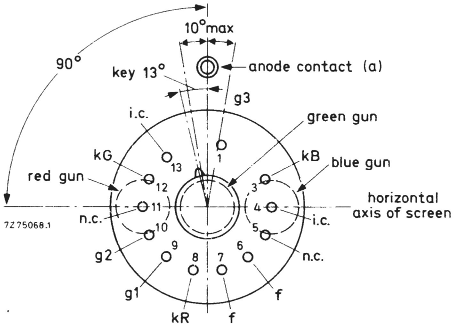
MECHANICAL DATA (continued)


14
±0,2
3 0
−0,5
7,5 (5)
30 (4)
max
25
14
±0,5
11
±0,2
7Z83840


382,3
5°
z
13 min (12)
R 6,5
mould match
line
37,5
±2,5
19,5
max
46
max
2
10,5
4 min (11)
7Z86129


(10)
z
y
x
382,3
322,1
241,6
17,3 ± 2,0
28,6 ± 2,0
8,4 ± 2,0
7Z83842


m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

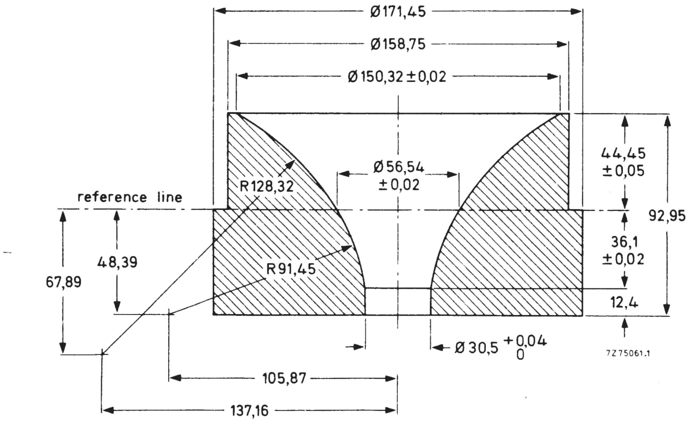

10° max
90°
key 13°
anode contact (a)
g3
i.c.
green gun
1
13
kG
kB
blue gun
red gun
12
3
11
4
horizontal
axis of screen
n.c.
i.c.
10
5
9
6
g2
8
7
n.c.
g1
f
kR
f
7Z75068.1

Notes to outline drawings on the preceding pages

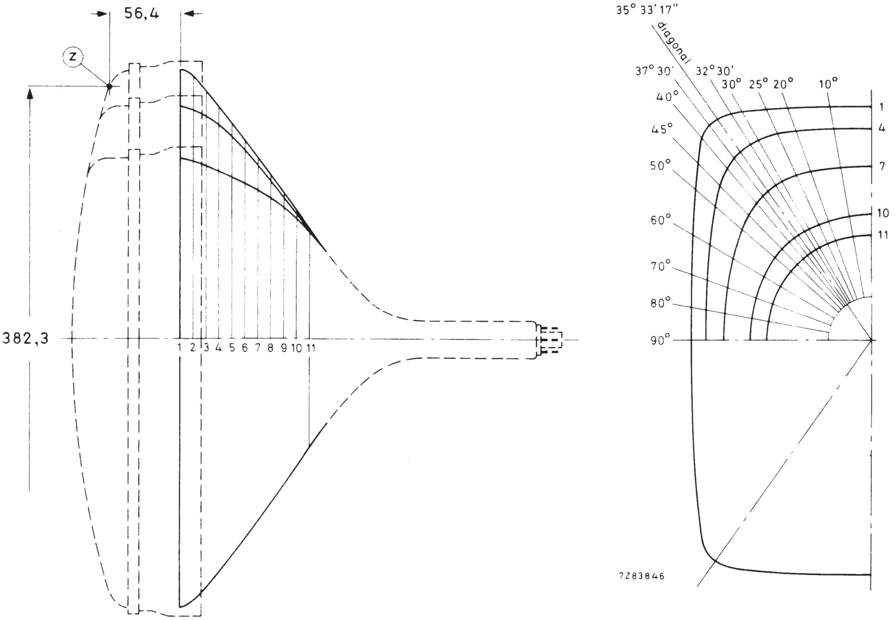
1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. One of the four mounting lugs may deviate (2,0 mm max.) from the plane of the other three lugs. This deviation is incorporated in the tolerance of ± 2,5 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 7,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 355,8 mm x 276,7 mm.
6. Co-ordinates for radius R = 11,1 mm: x = 146,52 mm, y = 104,72 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.

DEVELOPMENT SAMPLE DATA

Reference line gauge; GR90CJ4



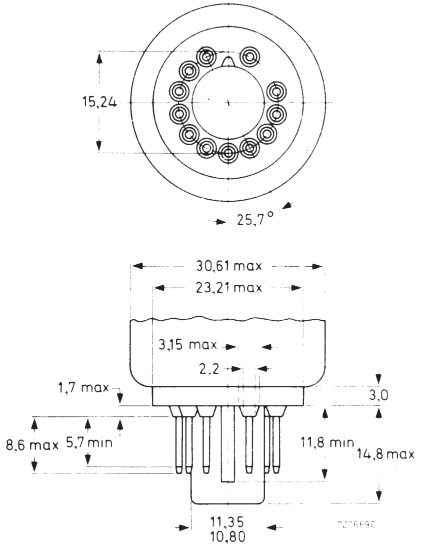
Maximum cone contour

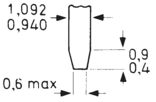


section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	diag. axes	37°30'	40°	45°	50°	60°	70°	80°	90°
Dimensions in mm																
1	0	179,1	181,5	189,1	195,0	202,1	205,7	208,5	207,8	203,3	189,6	177,2	159,0	147,6	141,3	139,3
2	10	176,1	178,4	185,4	190,7	196,9	199,9	201,9	200,9	196,4	183,9	172,5	155,4	144,4	138,4	136,5
3	20	170,8	172,8	178,7	182,9	187,5	189,3	190,0	188,9	185,4	175,4	165,5	150,0	139,9	134,2	132,4
4	30	164,1	165,8	170,8	174,1	177,2	178,2	177,9	176,7	173,9	166,0	157,8	144,2	135,1	129,9	128,2
5	40	155,6	157,1	161,4	164,0	166,1	166,4	165,6	164,3	161,9	155,7	149,1	137,9	130,0	125,4	123,9
6	50	145,1	146,5	150,1	152,2	153,6	153,6	152,8	151,7	149,9	145,1	140,1	131,1	124,5	120,6	119,3
7	60	133,6	134,7	137,4	138,9	139,9	140,0	139,5	138,9	137,8	134,6	130,9	123,8	118,6	115,4	114,3
8	70	121,8	122,6	124,4	125,3	125,9	125,9	125,8	125,6	125,1	123,5	121,3	116,4	112,2	109,6	108,7
9	80	109,5	110,0	110,9	111,3	111,6	111,6	111,6	111,6	111,5	110,9	110,1	107,6	105,0	103,1	102,4
10	90	96,5	96,6	96,8	96,9	97,0	97,1	97,1	97,2	97,2	97,1	97,0	96,3	95,4	94,5	94,1
11	100	82,2	82,1	82,1	82,1	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,1

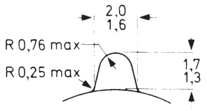
DEVELOPMENT SAMPLE DATA

12-pin base; JEDEC B12-262


15,24
25,7°
30,61 max
23,21 max
3,15 max
2,2
1,7 max
3,0
8,6 max
5,7 min
11,8 min
14,8 max
11,35
10,80


1,092
0,940
0,9
0,4
0,6 max

pin contour


2,0
1,6
R 0,76 max
R 0,25 max
1,7
1,3

detail of key

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,7 to 5,5	kV
Grid 2 voltage for a spot cut-off voltage V_k = 120 V	V_{g2}	310 to 560	V
Luminance at the centre of the screen *	L	180	cd/m^2

---

* Tube settings adjusted to produce white of 6500K + 7 M.P.C.D. (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	18,8 to 22% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart *
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs **
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 μA

To produce white of 6500K + 7 M.P.C.D.
(CIE co-ordinates x = 0,313, y = 0,329)

Percentage of the total anode current supplied by each gun (typical)	
red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode currents		
red gun to green gun	min.	0,7
	average	1,1
	max.	1,4
red gun to blue gun	min.	1,1
	average	1,5
	max.	2,0
blue gun to green gun	min.	0,5
	average	0,7
	max.	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 120 V. Increase the V_{g2} from about 300 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	max.	27,5	kV	notes 1, 2, 3
		min.	20	kV	notes 1 and 4
Long-term average current for three guns	I_a	max.	750	μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	7	kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000	V	
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Heater voltage	V_f	max.	7,2	V	note 6
		min.	5,4	V	
Heater-cathode voltage					
heater negative with respect to cathode					
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450	V	note 1
after equipment warm-up period	V_{kf}	max.	250	V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200	V	note 1
	$-V_{kf}$	max.	0	V	
		(d.c. component value)			

Notes

1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1000 μA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

FLASHOVER PROTECTION

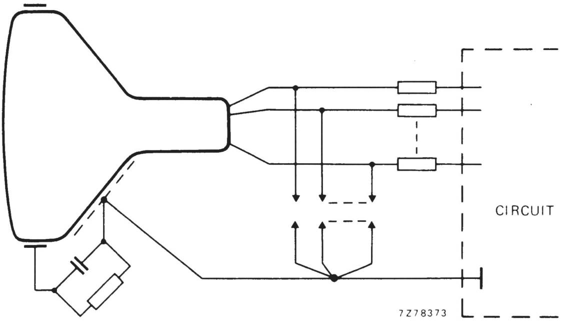
With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.

The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 8,5 kV ($1,5 \times V_{g3}$ max. at $V_{a,g4} = 25$ kV), and at the other electrodes of 1,5 to 2 kV.

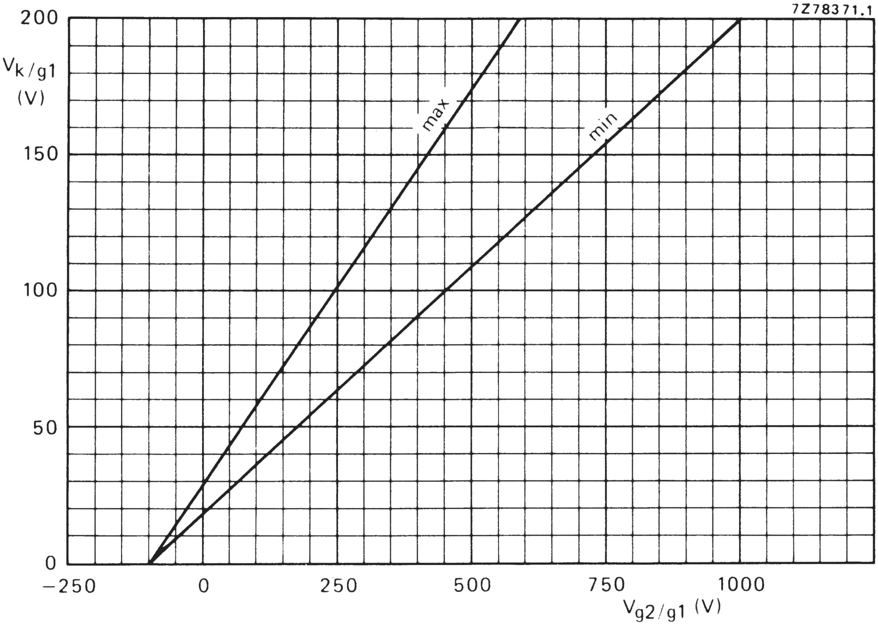
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.

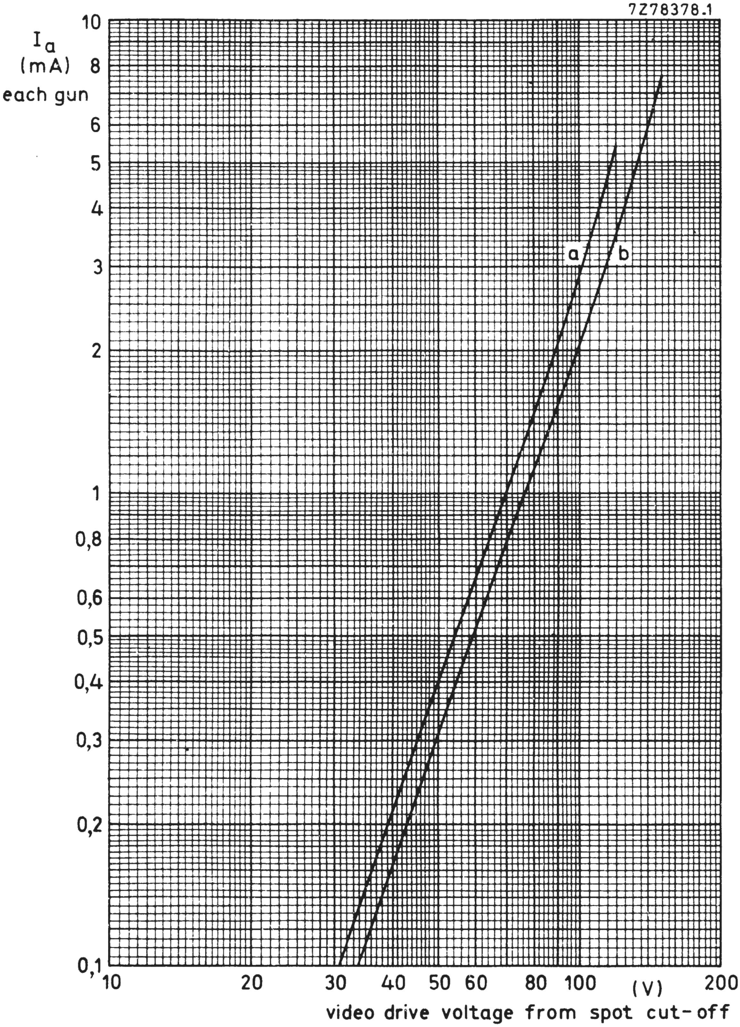


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	4,5 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2,3 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm

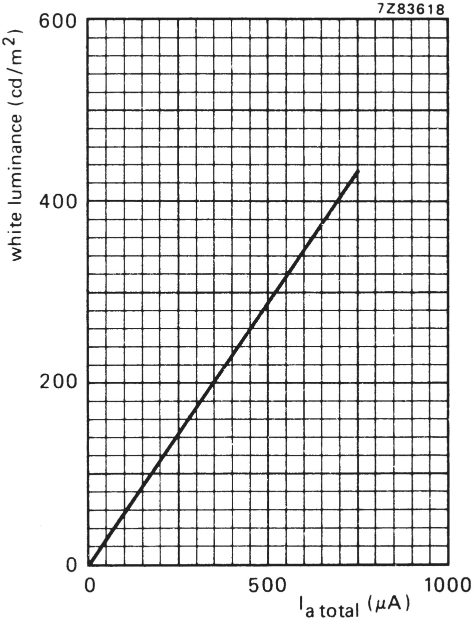


Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.

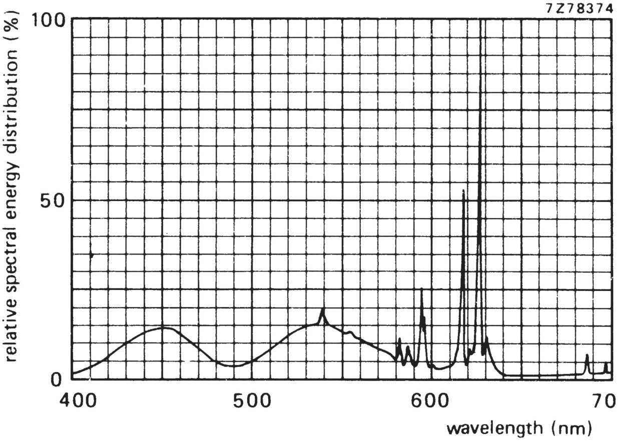


Typical cathode drive characteristics.
V_f = 6,3 V;
$V_{a,g4}$ = 25 kV;
V_{g3} adjusted for focus;
V_{g2} adjusted to provide spot cut-off for desired fixed V_k.

curve a = spot cut-off = 120 V;
curve b = spot cut-off = 150 V.

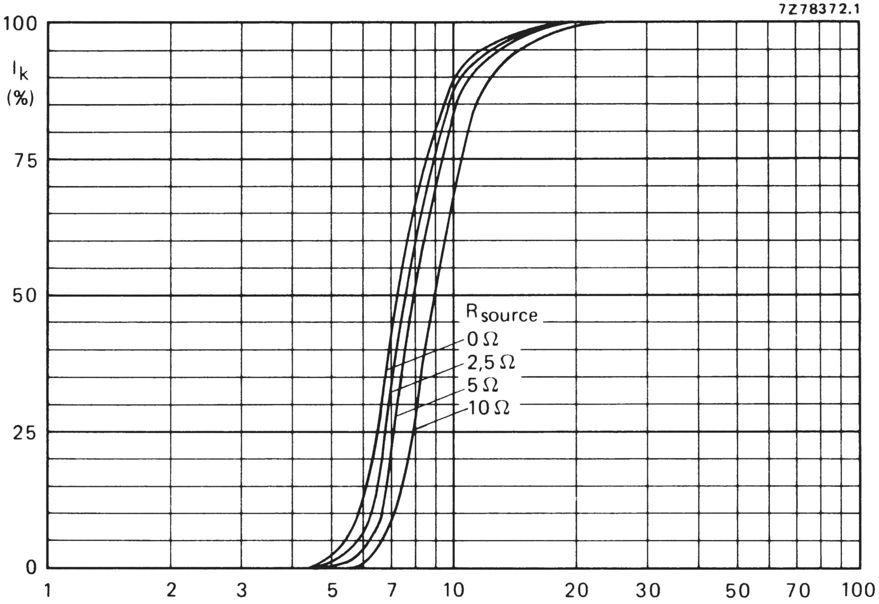


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV, V_f = 6,3 V, V_{g3} adjusted for optimum focus.
Scanned area = 322,1 mm x 241,6 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

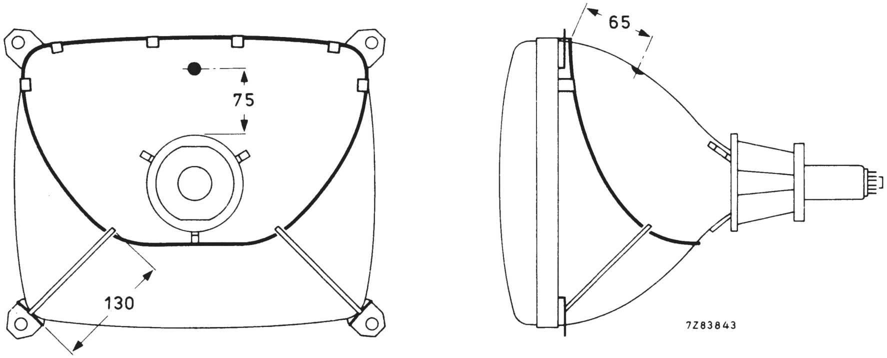
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



Cathode heating time after switching on, measured under typical operating conditions.

DEGAUSSING

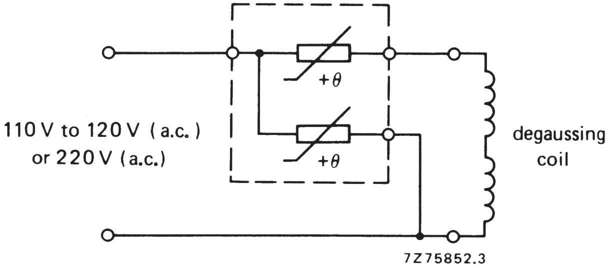
The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of one magnetic coil winding mounted on the cone of the picture tube.



Position of degaussing coil on the picture tube; dimensions are given in mm.

For proper degaussing an initial magnetomotive force (m.m.f.) of 600 ampere-turns is required in the coil. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coil (⩽ 0,6 ampere-turns). If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents. An example of a degaussing circuit and coil data for various mains voltages are given below.

DEVELOPMENT SAMPLE DATA



Degaussing circuit using dual PTC thermistor.

Data of degaussing coil

	110 V (a.c.) mains	220 V (a.c.) mains
Circumference	105 cm	105 cm
Number of turns	70	120
Copper-wire diameter	0,5 mm	0,35 mm
Resistance	6,3 Ω	22,3 Ω
Catalogue number of appropriate dual PTC thermistor	8222 298 73091	2322 662 98009

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic hi-bi-potential focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphor featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Reinforced envelope for push-through mounting
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1216 or DT1470), it forms a self-converging and raster correction free assembly.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	42 cm
Overall length	379 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	hi-bi-potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 1600 pF min. 1000 pF
grid 1 to all other electrodes	C_{g1}	17 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 382,3 mm
horizontal axis	min. 322,1 mm
vertical axis	min. 241,6 mm
area	min. 755 cm^2
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,70 mm
Light transmission of face glass at centre	68%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	379,4 ± 5 mm
Neck diameter	$29,1^{+1,4}_{-0,7}$ mm *
Bulb dimensions	
diagonal	max. 418,8 mm
width	max. 360,6 mm
height	max. 281,6 mm
Base	10-pin base JEDEC B10-277
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 8 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

DEVELOPMENT SAMPLE DATA

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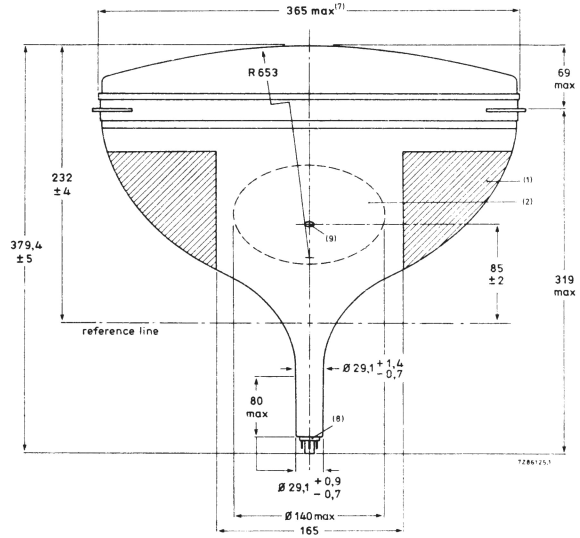
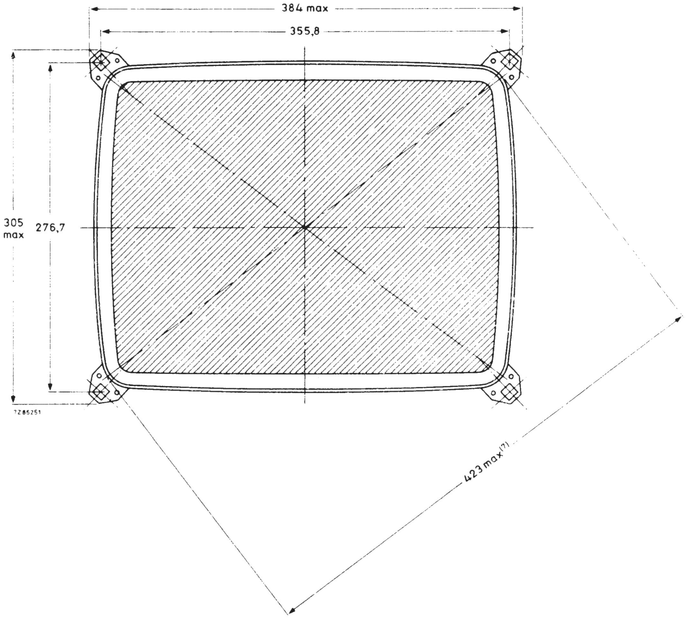
* In the region of 80 mm from the neck end, the maximum diameter is 30 mm.

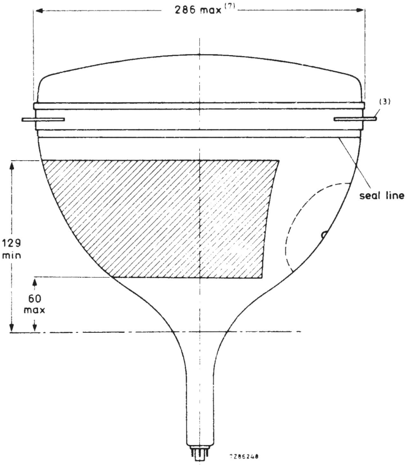
MECHANICAL DATA (continued)

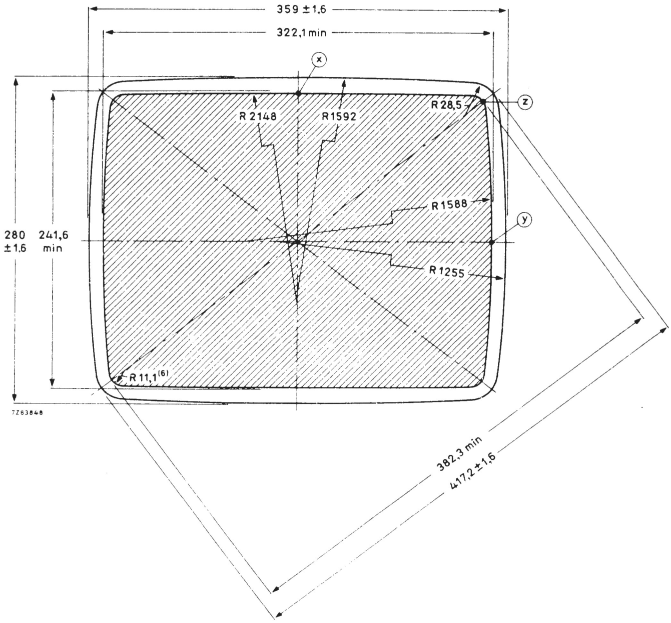
Dimensions in mm

Notes are given after the drawings.

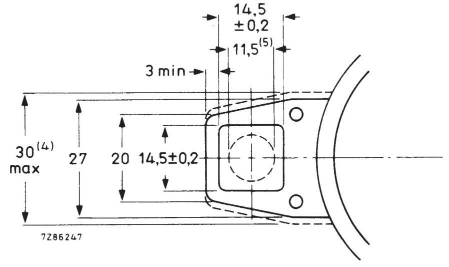

365 max(7)
R 653
69
max
232
±4
379,4
±5
(1)
(2)
(9)
85
±2
319
max
reference line
Ø 29,1 +1,4 −0,7
80
max
(8)
Ø 29,1 +0,9 −0,7
Ø 140 max
165
7Z86125.1

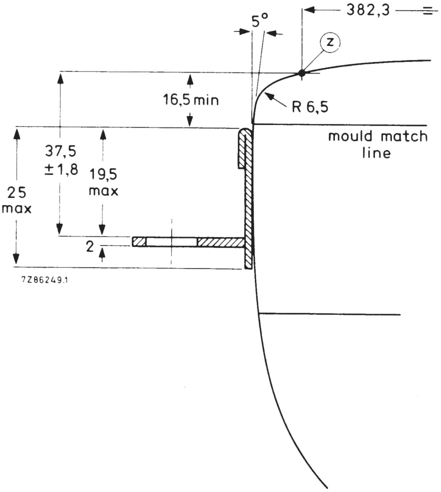

384 max
355,8
305
max
276,7
7Z86251
423 max(7)

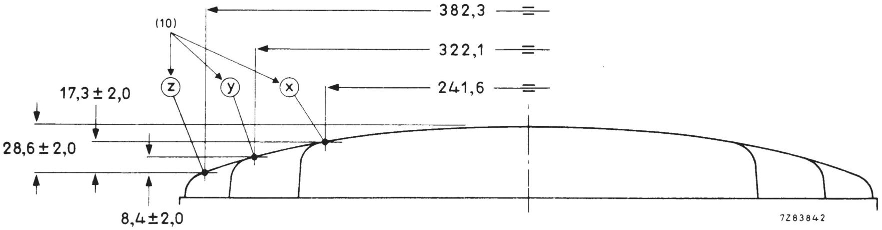

286 max (7)
(3)
seal line
129 min
60 max
7Z86248

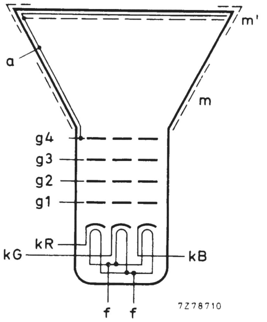

359 ±1,6
322,1 min
x
R 2148
R1592
R 28,5
z
R1588
y
280 ±1,6
241,6 min
R1255
R 11,1 (6)
7Z83848
382,3 min
417,2 ±1,6

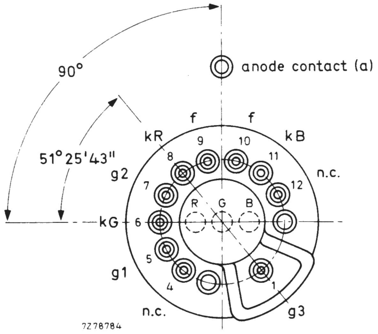
MECHANICAL DATA (continued)


14,5
±0,2
11,5(5)
3 min
30(4)
max
27
20
14,5±0,2
7Z86247


382,3
5°
z
16,5 min
R 6,5
mould match
line
37,5
±1,8
19,5
max
25
max
2
7Z86249.1


382,3
322,1
241,6
(10)
z
y
x
17,3 ± 2,0
28,6 ± 2,0
8,4 ± 2,0
7Z83842

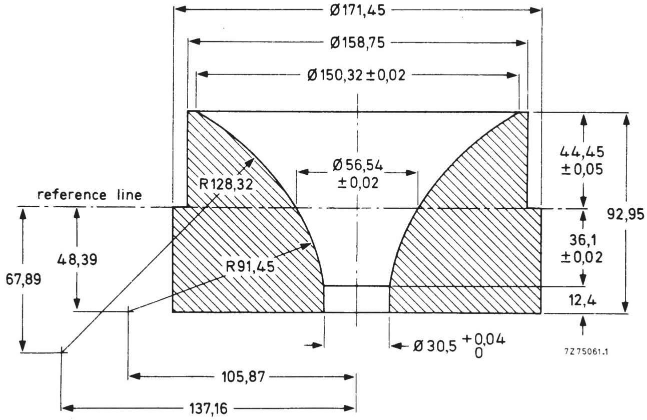

m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

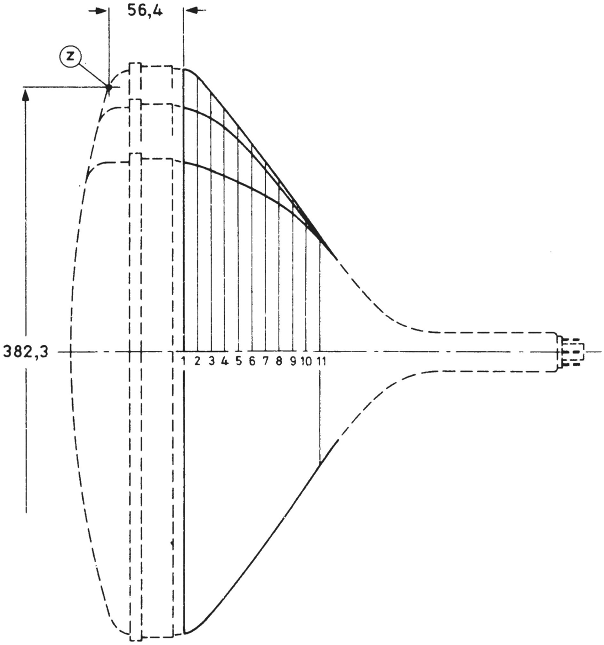

90°
anode contact (a)
51° 25' 43"
f
f
kR
kB
9
10
8
11
g2
n.c.
7
12
R
G
B
kG
6
5
g1
4
1
n.c.
g3
7Z78784

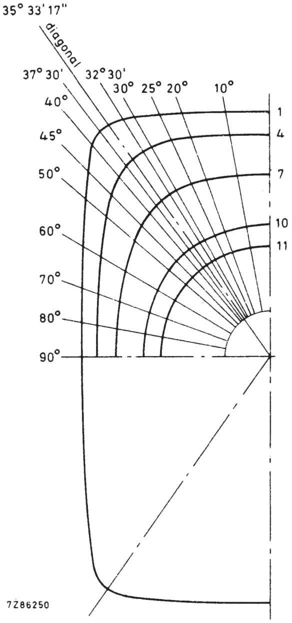
Notes to outline drawings on the preceding pages

1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. One of the four mounting lugs may deviate (1,5 mm max.) from the plane of the other three lugs. This deviation is incorporated in the tolerance of ± 1,8 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 11,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 355,8 mm x 276,7 mm.
6. Co-ordinates for radius R = 11,1 mm: x = 146,52 mm, y = 104,72 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC 67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.

Reference line gauge; GR90CJ4

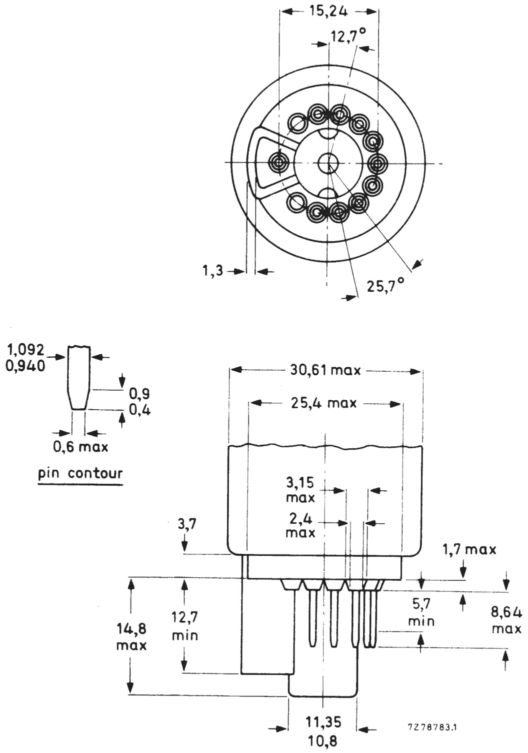






section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	diag. axes	37°30'	40°	45°	50°	60°	70°	80°	90°
Dimensions in mm																
1	0	179,1	181,5	189,1	195,0	202,1	205,7	208,5	207,8	203,3	189,6	177,2	159,0	147,6	141,3	139,3
2	10	176,1	178,4	185,4	190,7	196,9	199,9	201,9	200,9	196,4	183,9	172,5	155,4	144,4	138,4	136,5
3	20	170,8	172,8	178,7	182,9	187,5	189,3	190,0	188,9	185,4	175,4	165,5	150,0	139,9	134,2	132,4
4	30	164,1	165,8	170,8	174,1	177,2	178,2	177,9	176,7	173,9	166,0	157,8	144,2	135,1	129,9	128,2
5	40	155,6	157,1	161,4	164,0	166,1	166,4	165,6	164,3	161,9	155,7	149,1	137,9	130,0	125,4	123,9
6	50	145,1	146,5	150,1	152,2	153,6	153,6	152,8	151,7	149,9	145,1	140,1	131,1	124,5	120,6	119,3
7	60	133,6	134,7	137,4	138,9	139,9	140,0	139,5	138,9	137,8	134,6	130,9	123,8	118,6	115,4	114,3
8	70	121,8	122,6	124,4	125,3	125,9	125,9	125,8	125,6	125,1	123,5	121,3	116,4	112,2	109,6	108,7
9	80	109,5	110,0	110,9	111,3	111,6	111,6	111,6	111,6	111,5	110,9	110,1	107,6	105,0	103,1	102,4
10	90	96,5	96,6	96,8	96,9	97,0	97,1	97,1	97,2	97,2	97,1	97,0	96,3	95,4	94,5	94,1
11	100	82,2	82,1	82,1	82,1	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,2	82,1

10-pin base; JEDEC B10-277


15,24
12,7°
1,3
25,7°
1,092
0,940
0,9
0,4
0,6 max
pin contour
30,61 max
25,4 max
3,15
max
2,4
max
3,7
1,7 max
14,8
max
12,7
min
5,7
min
8,64
max
11,35
10,8
7Z78783.1

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,6 to 7,5 kV
Grid 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	390 to 760 V
Luminance at the centre of the screen*	L	180 cd/m^2

---

* Tube settings adjusted to produce white of 6500K + 7 M.P.C.D. (x = 0,313, y = 0,329) focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26,6 to 29,8% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart *
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs **
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 µA
Grid 2 current	I_{g2}	−5 to + 5 µA
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 µA
To produce white of 6500K + 7 M.P.C.D. (CIE co-ordinates x = 0,313, y = 0,329)		
Percentage of the total anode current supplied by each gun (typical)		
red gun		38,3%
green gun		35,8%
blue gun		25,9%
Ratio of anode currents		
red gun to green gun		min. 0,7 average 1,1 max. 1,4
red gun to blue gun		min. 1,1 average 1,5 max. 2,0
blue gun to green gun		min. 0,5 average 0,7 max. 1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 140 V. Increase the V_{g2} from about 400 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	max.	27,5 kV	notes 1, 2, 3
		min.	20 kV	notes 1 and 4
Long-term average current for three guns	I_a	max.	750 μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	11 kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000 V	
Cathode voltage				
positive	V_k	max.	400 V	
positive operating cut-off	V_k	max.	200 V	
negative	$-V_k$	max.	0 V	
negative peak	$-V_{kp}$	max.	2 V	
Heater voltage	V_f	max.	7,2 V	note 6
		min.	5,4 V	
Heater-cathode voltage				
heater negative with respect to cathode				
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450 V	note 1
after equipment warm-up period	V_{kf}	max.	250 V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200 V	note 1
	$-V_{kf}$	max.	0 V	
		(d.c. component value)		

Notes

1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1000 μA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

FLASHOVER PROTECTION

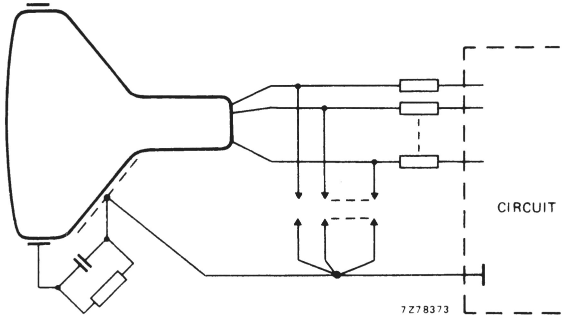
With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.

The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of **11 kV** (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.

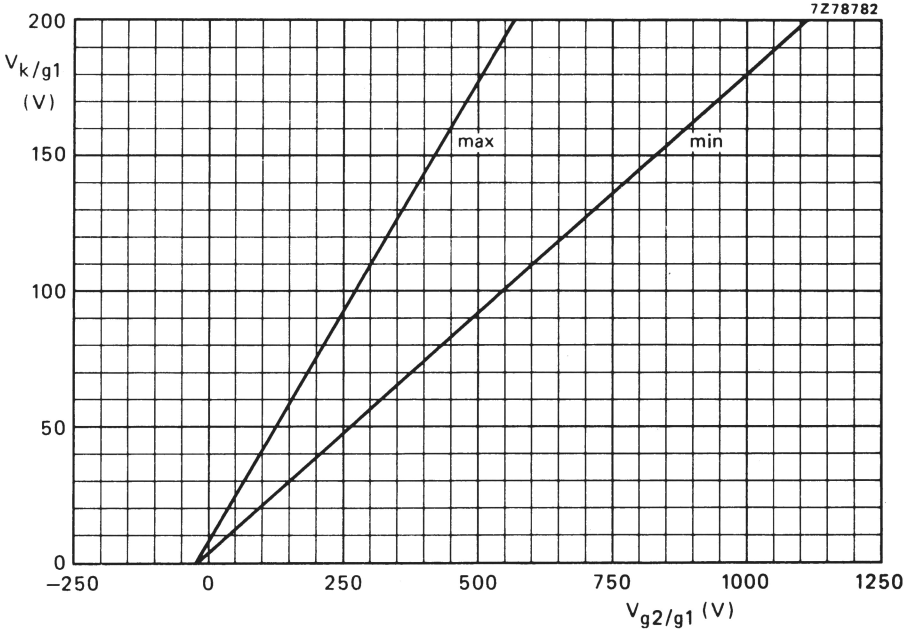
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.

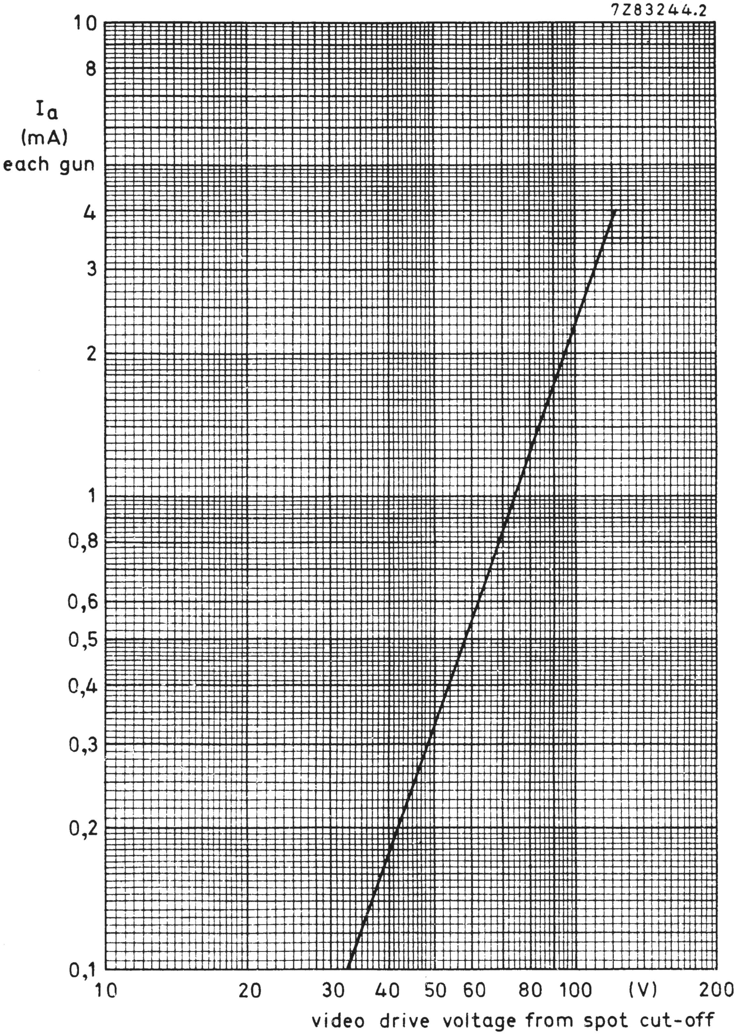


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	4,5 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2,3 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm

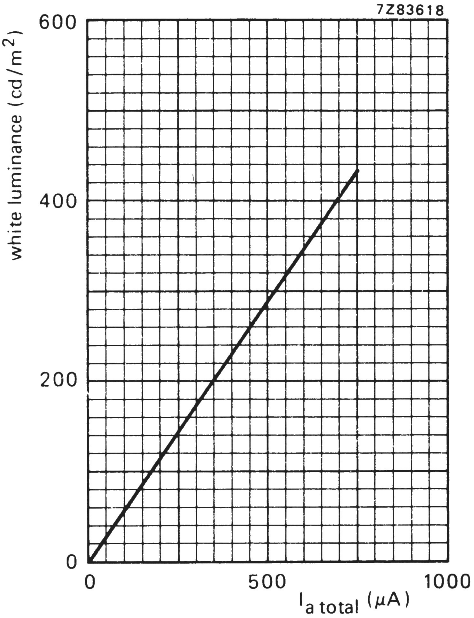


Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.

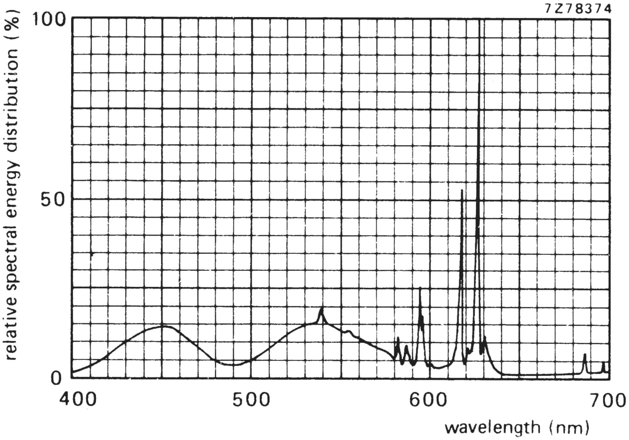


Typical cathode drive characteristics.
V_f = 6,3 V;
$V_{a,g4}$ = 25 kV;
V_{g3} adjusted for focus;
V_{g2} adjusted to provide spot cut-off for V_k = 140 V.

DEVELOPMENT SAMPLE DATA

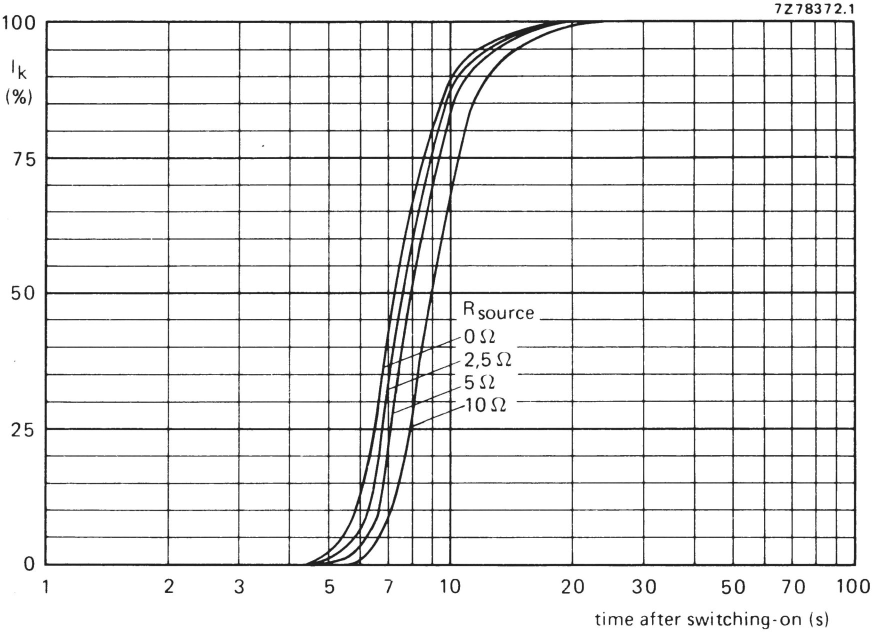


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV, V_f = 6,3 V, V_{g3} adjusted for optimum focus.
Scanned area = 322,1 mm x 241,6 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

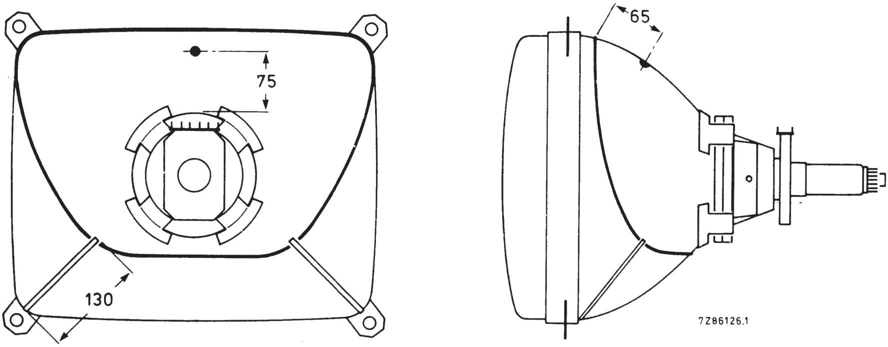
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



Cathode heating time after switching on, measured under typical operating conditions.

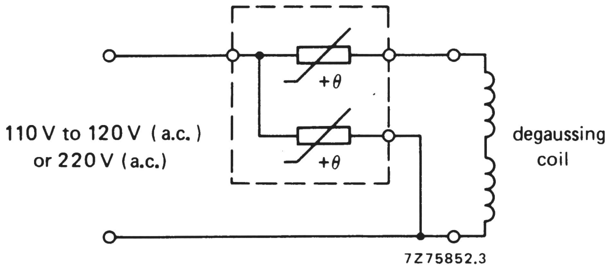
DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of one magnetic coil winding mounted on the cone of the picture tube.



Position of degaussing coil on the picture tube; dimensions are given in mm.

For proper degaussing an initial magnetomotive force (m.m.f.) of 600 ampere-turns is required in the coil. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coil (⩽ 0,6 ampere-turns). If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents. An example of a degaussing circuit and coil data for various mains voltages are given below.



Degaussing circuit using dual PTC thermistor.

Data of degaussing coil

	110 V (a.c.) mains	220 V (a.c.) mains
Circumference	105 cm	105 cm
Number of turns	70	120
Copper-wire diameter	0,5 mm	0,35 mm
Resistance	6,3 Ω	22,3 Ω
Catalogue number of appropriate dual PTC thermistor	8222 298 73091	2322 662 98009

COLOUR PICTURE TUBE

Replacement type A51-510X.

20AX Hi-Bri COLOUR PICTURE TUBE

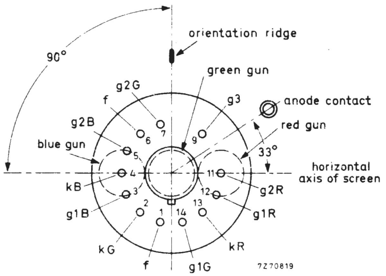
QUICK REFERENCE DATA

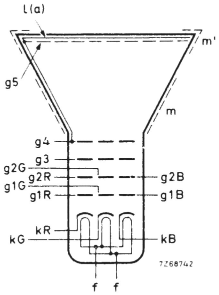
Deflection angle	110°
Face diagonal	51 cm
Overall length	35 cm
Neck diameter	36,5 mm
Envelope	reinforced; suitable for push-through
Magnetic shield	internal
Focusing	bi-potential
Deflection	magnetic
Heating	6,3 V, 720 mA
Light transmission of face glass	64%
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s

Inherently self-converging system with deflection unit AT1085

MECHANICAL DATA

Overall length	351,4 ± 6,5 mm
Neck diameter	$36,5\,^{+1,6}_{-0}$ mm
Bulb dimensions	
diagonal	max. 515,5 mm
width	max. 442,5 mm
height	max. 343,8 mm
Useful screen dimensions	
diagonal	min. 480,0 mm
horizontal axis	min. 404,4 mm
vertical axia	min. 303,3 mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	small cavity contact J1-21, IEC 67-III-2


90°
orientation ridge
green gun
g2G
f
g3
anode contact
g2B
red gun
blue gun
33°
horizontal axis of screen
kB
g2R
g1B
g1R
kG
kR
f
g1G
1
2
3
4
5
6
7
9
11
12
13
14
7Z70819


l(a)
m'
g5
m
g4
g3
g2G
g2R
g1G
g1R
g2B
g1B
kR
kG
kB
f
f
7Z68742

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Final accelerator voltage	$V_{a,g5,g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8 kV
Grid 2 voltage for a spot-cut-off voltage V_k = 140 V	V_{g2}	465 to 705 V
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165 V

30AX COLOUR PICTURE TUBE

- Automatic snap-in raster orientation
- Push-on axial purity positioning
- Internal magneto-static beam alignment
- Hi-Bi gun with quadrupole cathode lens
- Self-aligning, self-converging assembly with low power consumption, when combined with deflection unit AT 1250
- North-south pin-cushion distortion-free
- 110° deflection
- Hi-Bri screen
- Pigmented phosphors: enhanced contrast
- Phosphor lines follow glass contour
- In-line gun
- Standard 36,5 mm neck
- Soft-Flash technology
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Quick-heating cathodes
- Internal magnetic shield
- Anti-crackle coating
- Reinforced envelope for push-through mounting

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	51 cm
Overall length	36 cm
Neck diameter	36,5 mm
Heating	6,3 V, 720 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	in-line with separate grids
Focusing method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	110°
horizontal	97°
vertical	77°

ELECTRICAL DATA

Capacitances				
anode to external conductive coating	$C_{a,\ g5,\ g4/m}$	max.	1400	pF
		min.	900	pF
anode to metal rimband	$C_{a,\ g5,\ g4/m'}$		250	pF
grid of any gun to all other electrodes	$C_{g\ 1R}$, $C_{g\ 1G}$, $C_{g\ 1B}$		7	pF
cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4	pF
grid 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF
Resistance between rimband and external conductive coating		min.	50	MΩ
Heating: indirect by a.c. (preferably mains or line frequency) or d.c.				
heater voltage	V_f		6,3	V*
heater current	I_f		720	mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 480,0 mm
horizontal axis	min. 404,4 mm
vertical axis	min. 303,3
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type

---

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V. For heating time as a function of source impedance see graph on the last page but one of this data sheet.

Colour co-ordinates	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060

Centre-to-centre distance of identical colour phosphor stripes	approx. 0,8 mm
Light transmission of face glass	64%
Luminance at the centre of the screen	L 160 cd/m² *

MECHANICAL DATA (see also the figures on the following pages)

Overall length	361,4 ± 6 mm
Neck diameter	$36{,}5\,^{+1{,}3}_{-0}$ mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	cavity cap JEDEC J1-21, IEC 67-III-2
Mounting position	anode contact on top
Rimband	provided with 18 slots to accommodate clips for mounting of degaussing coils
Net mass	approx. 12 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s² in any direction.

Notes to outline drawings on the following pages

1. This ridge can be used as an orientation for the deflection unit.
2. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
3. To clean this area, wipe only with a soft lintless cloth.
4. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
5. Minimum space to be reserved for mounting lug.
6. The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 434 mm x 337 mm.
7. Co-ordinates for radius R = 13,1 mm: x = 184,58 mm, y = 131,93 mm.
8. Distance from point z to any hardware.
9. Maximum dimensions in plane of lugs.
10. The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The bottom circumference of the base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.
    The mass of the mating socket with circuitry should not be more than 150 g; maximum permissible torque is 40 mNm.
11. Minimum distance between glass and rimband in plane of centre line of apertures.
12. Centring bosses for deflection unit.

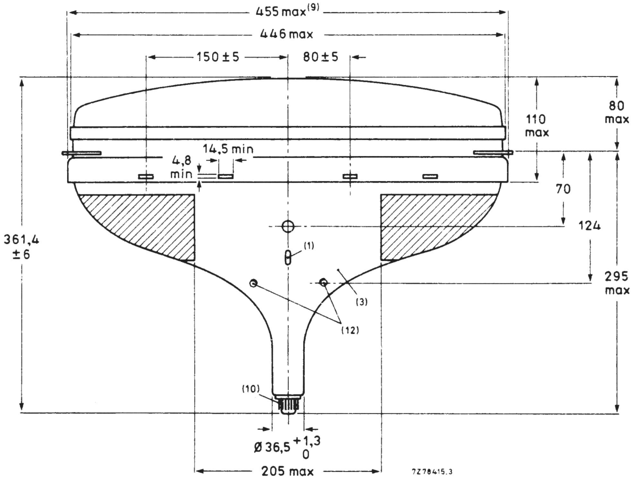
---

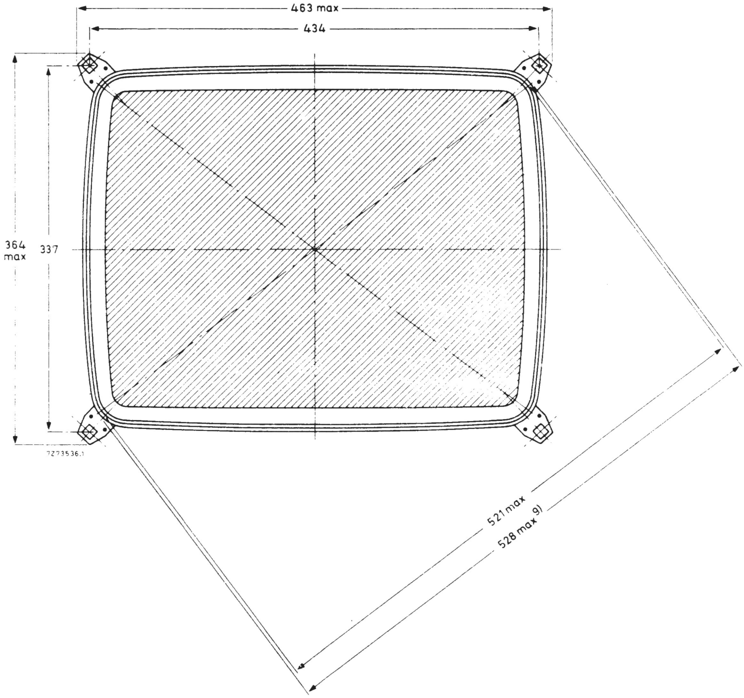
* Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm².

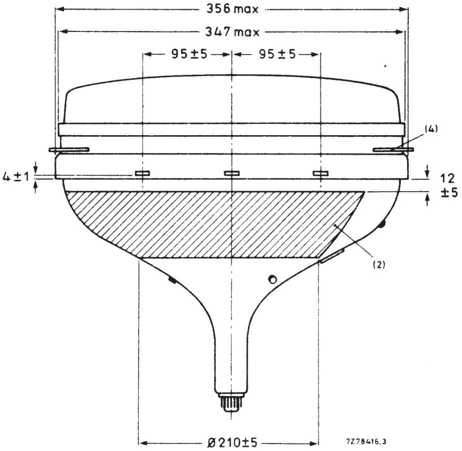
MECHANICAL DATA (continued)

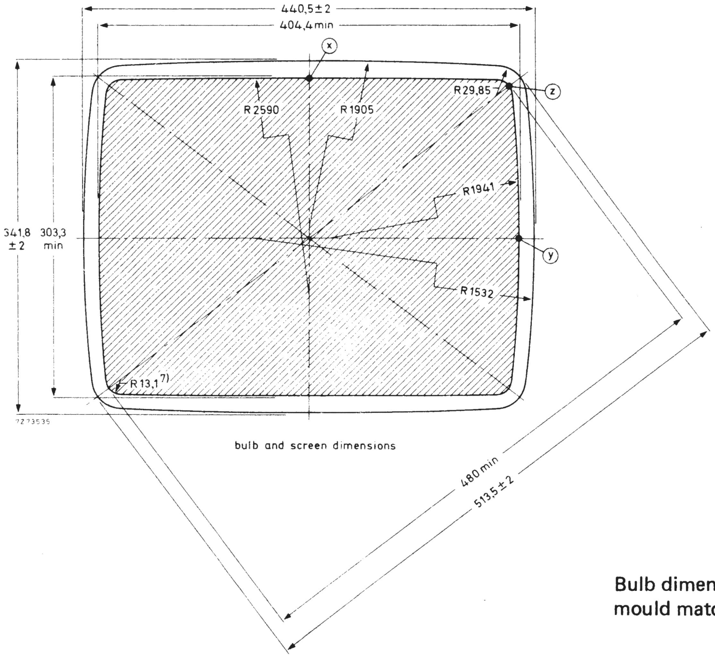
Dimensions in mm

Notes are on the preceding page


455 max (9)
446 max
150 ± 5
80 ± 5
110 max
80 max
14,5 min
4,8 min
70
124
361,4 ± 6
295 max
(1)
(3)
(12)
(10)
Ø 36,5 +1,3 0
205 max
7Z78415.3


463 max
434
364 max
337
521 max
528 max 9)
7Z73536.1

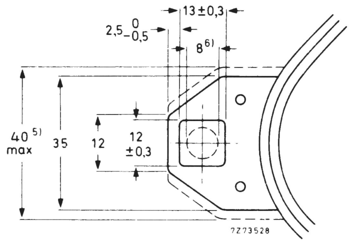

356 max
347 max
95±5
95±5
(4)
4±1
12
±5
(2)
Ø210±5
7Z78416.3

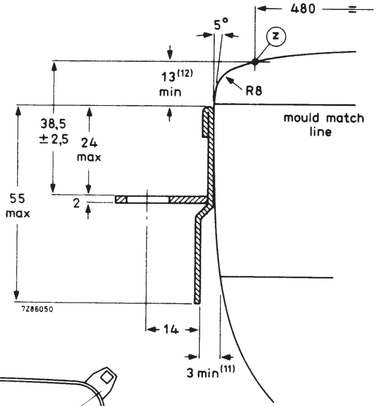

440,5±2
404,4 min
x
R 2590
R 1905
R 29,85
z
R 1941
341,8
±2
303,3
min
y
R 1532
R 13,1 7)
7Z73535
480 min
513,5±2

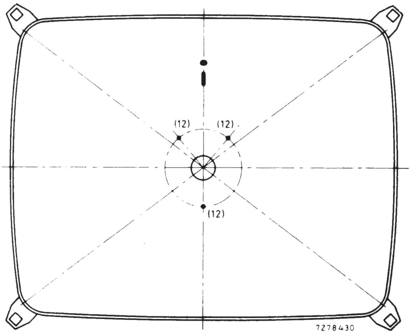
bulb and screen dimensions

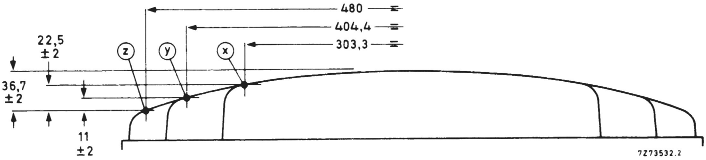
Bulb dimensions at mould match line.

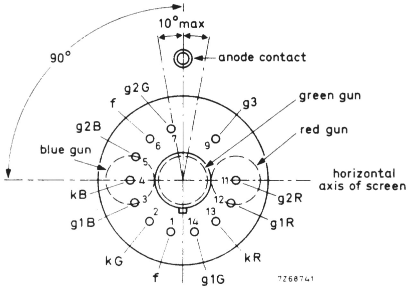
MECHANICAL DATA (continued)

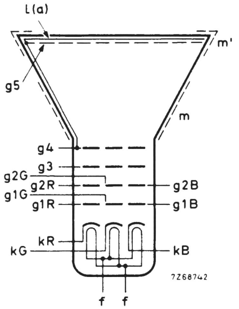

13 ±0,3
2,5 0 −0,5
8 6)
40 5) max
35
12
12 ±0,3
7Z73528


480
5°
z
13 (12) min
R8
mould match line
38,5 ±2,5
24 max
55 max
2
14
3 min (11)
7Z86050

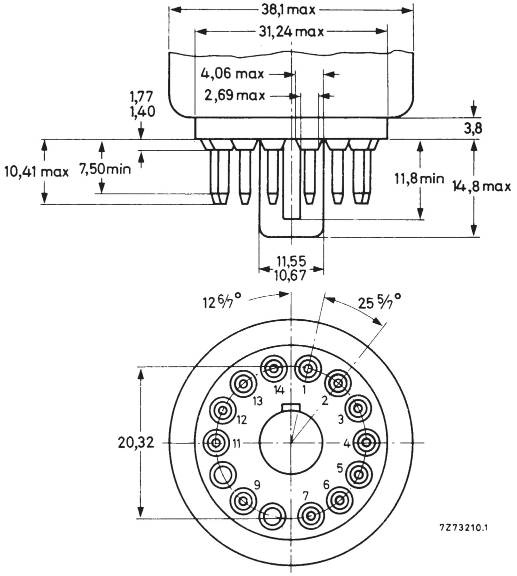

(12)
(12)
(12)
7Z78430

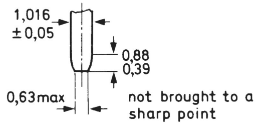

480
404,4
303,3
z
y
x
22,5 ±2
36,7 ±2
11 ±2
7Z73532.2


10° max
90°
anode contact
g2G
f
g3
green gun
g2B
red gun
blue gun
horizontal axis of screen
kB
g2R
g1B
g1R
kG
kR
f
g1G
1
2
3
4
5
6
7
9
11
12
13
14
7Z68741

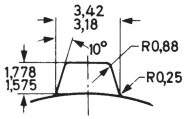

l(a)
m'
g5
m
g4
g3
g2G
g2R
g2B
g1G
g1R
g1B
kR
kG
kB
f
f
7Z68742

12-pin base, IEC67-I-47a, type 2


38,1 max
31,24 max
4,06 max
2,69 max
1,77
1,40
3,8
10,41 max
7,50min
11,8min
14,8 max
11,55
10,67
12 6/7°
25 5/7°
20,32
14
1
2
3
4
5
6
7
9
11
12
13
7Z73210.1

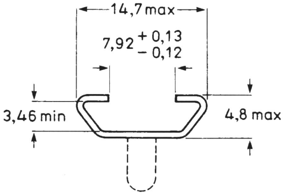

1,016
± 0,05
0,88
0,39
0,63max
not brought to a
sharp point

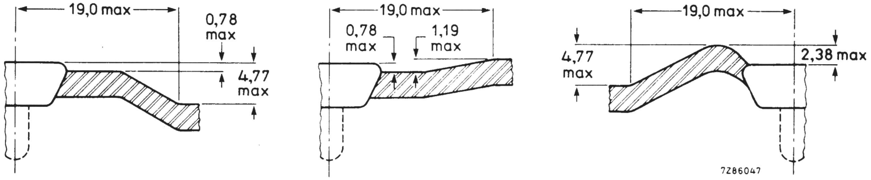
pin contour


3,42
3,18
10°
R0,88
R0,25
1,778
1,575

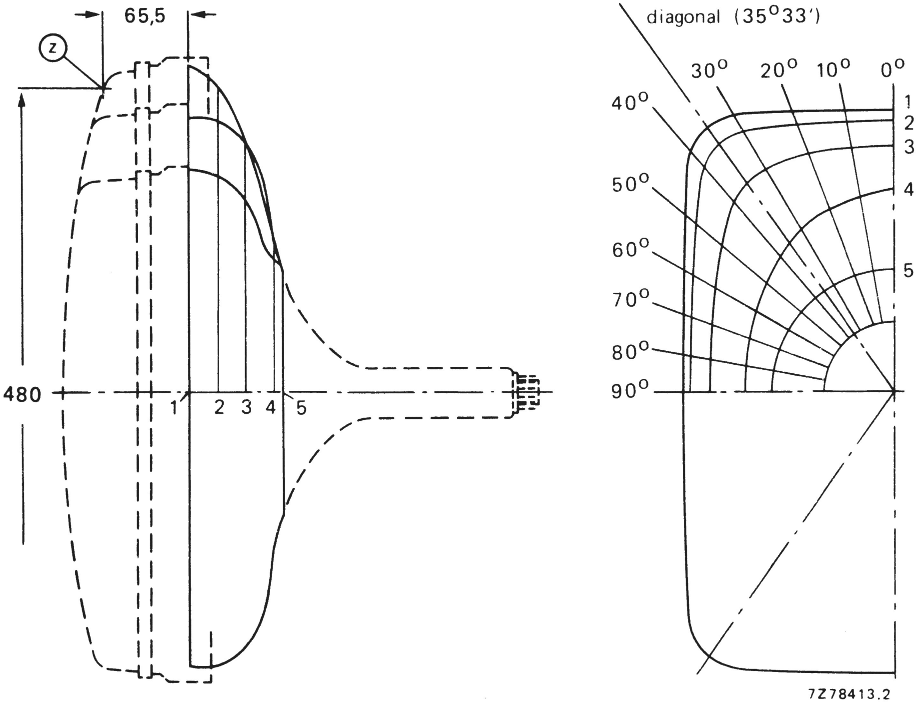
detail of key

Cavity cap JEDEC J1-21, IEC 67-III-2


14,7 max
7,92 + 0,13 − 0,12
3,46 min
4,8 max


19,0 max
0,78
max
4,77
max
19,0 max
0,78
max
1,19
max
19,0 max
4,77
max
2,38 max
7Z86047

Maximum cone contour


65,5
z
480
1
2
3
4
5
diagonal (35°33′)
30°
20°
10°
0°
40°
50°
60°
70°
80°
90°
1
2
3
4
5
7Z78413.2

sec-tion	nom. distance from section 1	distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	222	225	236	254	258	252	217	193	178	172	170
2	20	216	217	226	240	244	238	205	185	172	165	163
3	40	195	195	200	204	205	198	180	166	156	150	148
4	60	162	158	154	148	144	141	134	128	123	121	121
5	74	98	98	98	98	98	98	98	98	98	98	98

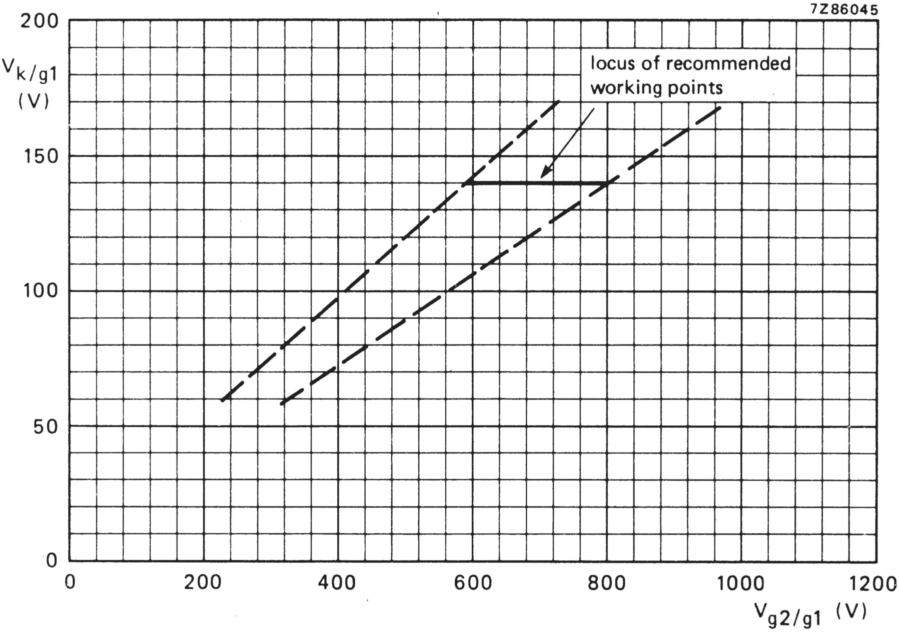
RECOMMENDED OPERATING CONDITIONS (cathode drive)

The voltages are specified with respect to grid 1.

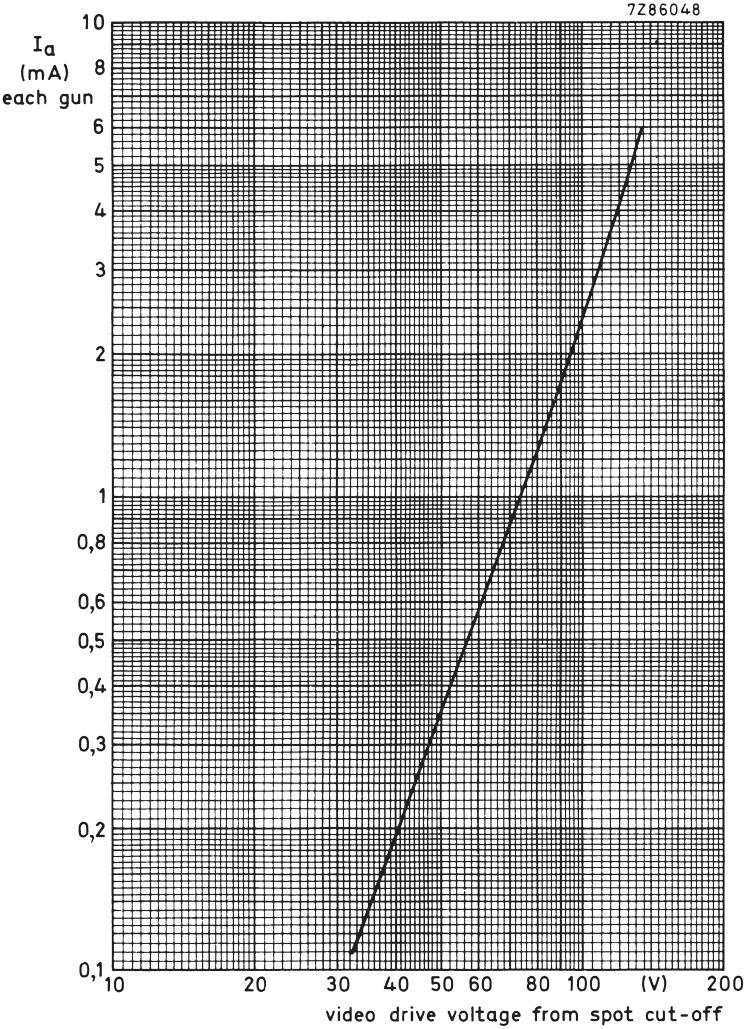
Anode voltage	$V_{a, g5, g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,5 to 7,45 kV

A. **Operation at equal spot cut-off voltage V_k = 140 V**

Grid 2 voltage (V_{g2}) adjusted for each gun separately; V_{g2} range 590 to 800 V.



Spot cut-off design chart.



Typical cathode drive characteristic.

V_f = 6,3 V ;

$V_{a,\ g5,\ g4}$ = 25 kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for V_k = 140 V.

B. Operation at equal grid 2 voltage

Grid 2 voltage (V_{g2}) adjusted for highest gun spot cut-off voltage V_k = 150 V.

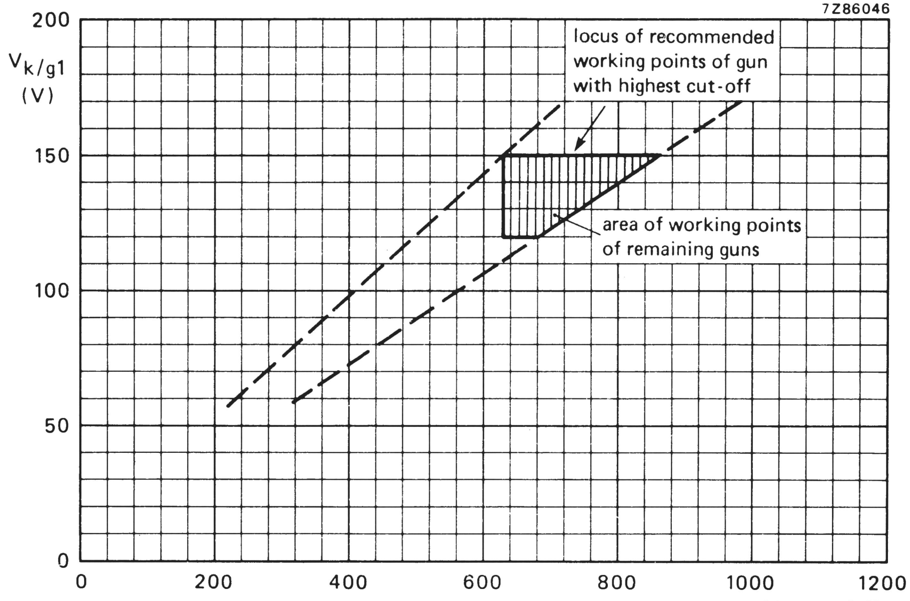
Remaining guns adjusted for spot cut-off by means of cathode voltage.

V_{g2} range 630 to 860 V.

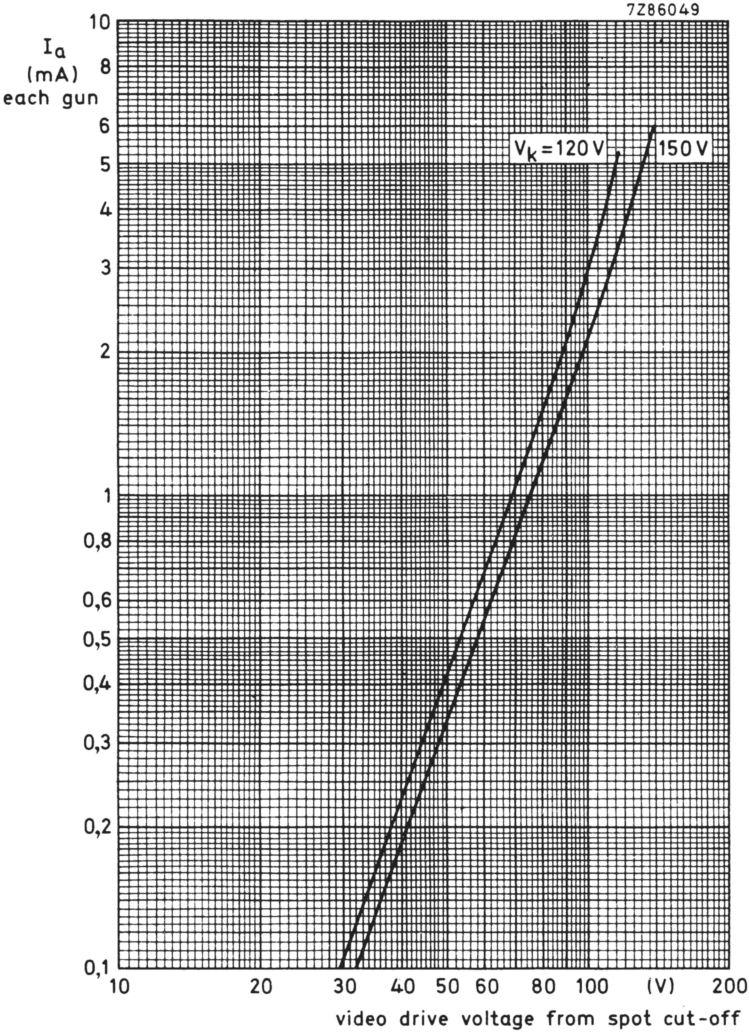
V_k range 120 to 150 V.

Adjustment procedure:

Set the cathode voltage (V_k) for each gun at 150 V; increase the grid 2 voltage (V_{g2}) from approx. 600 V to the value at which one of the colours becomes just visible. Now decrease the cathode voltage of the remaining guns so that the other colours also become visible.



Spot cut-off design chart.



Typical cathode drive characteristic.

$V_f = 6{,}3$ V;

$V_{a,\ g5,\ g4} = 25$ kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for $V_k = 120$ V and 150 V.

EQUIPMENT DESIGN VALUES (each gun if applicable)

The values are valid for anode voltages between 22,5 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26 to 29,8% of final accelerator voltage
Difference in cut-off voltage between guns in one tube	ΔV_k	lowest value is min. 80% of highest value
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current at V_k = 140 V	I_{g1}	−5 to + 5 μA

To produce white D, CIE co-ordinates x = 0,313, y = 0,329.

Percentage of the total anode current supplied by each gun (typical)	
red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

BEAM CENTRING

Maximum centring error in any direction — 4,5 mm

LIMITING VALUES (each gun if applicable)

Design maximum rating system unless otherwise stated.

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a, g5, g4}$	max.	27,5	kV	notes 1, 2, 3
		min.	22,5	kV	note 4
Long-term average current for three guns	I_a	max.	1000	μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	9	kV	
Grid 2 voltage	V_{g2}	max.	1200	V	note 6
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Cathode to heater voltage					
positive	V_{kf}	max.	250	V	
positive peak	V_{kfp}	max.	300	V	note 1
negative	$-V_{kf}$	max.	135	V	
negative peak	$-V_{kfp}$	max.	180	V	note 1

Notes

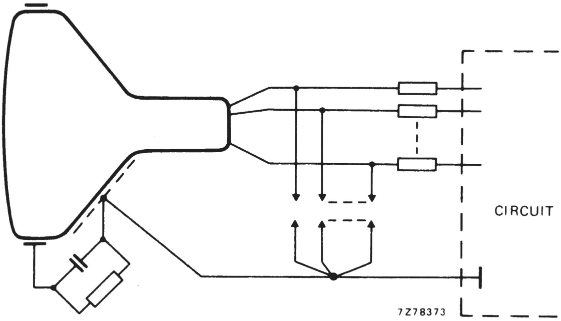
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 36 pA/kg (0,5 mR/h), measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution, and could impair convergence.
5. The short-term average anode current should be limited by circuitry to 1500 μA.
6. During adjustment on the production line max. 1500 V is permitted.

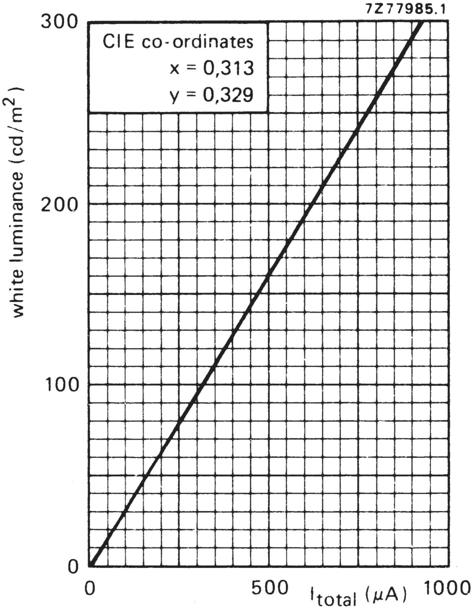
FLASHOVER PROTECTION

High electric field strengths are present between the gun electrodes of picture tubes. Voltages between gun electrodes may reach values of 20 kV over approx. 1 mm. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

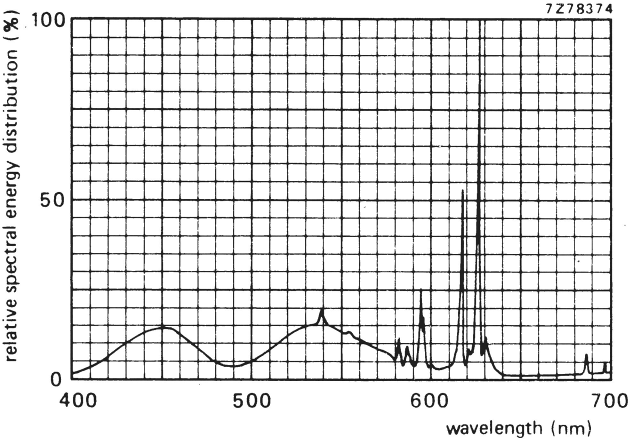
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage and damage to the circuitry which is directly connected to the tube socket. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible. The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 10,5 kV, and at the other electrodes of 1,5 to 2 kV. The values of the series isolation resistors should be as high as possible (min 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.



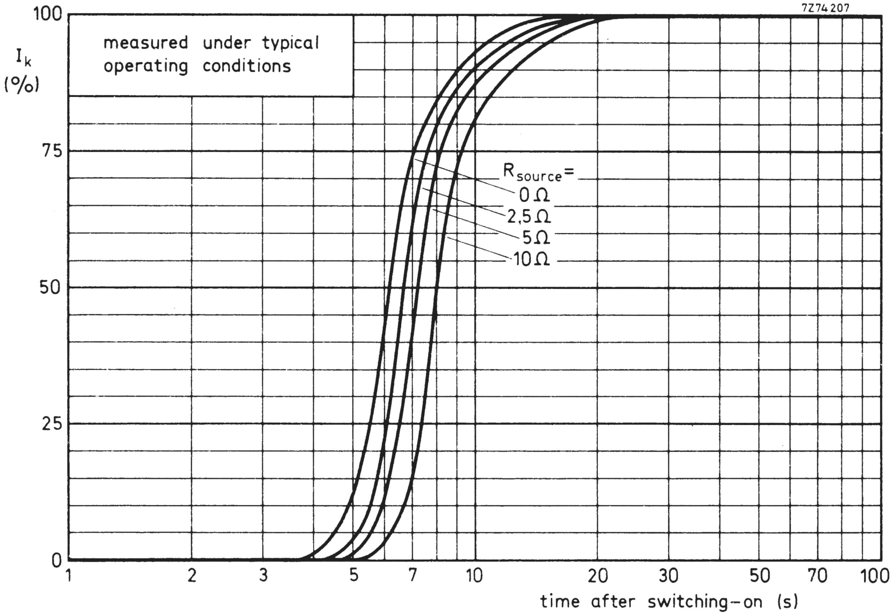


Luminance at the centre of the screen as a function of I_{total}. Scanned area 518 mm x 390 mm.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to provide white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

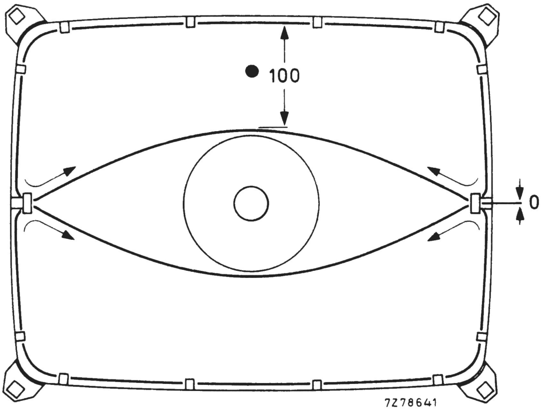
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



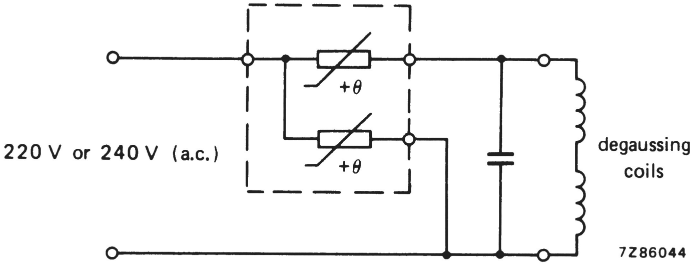
Cathode heating time to attain a certain percentage of the cathode current at equilibrium conditions.

DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts.
For proper degaussing an initial magnetomotive force (m.m.f.) of 250 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (⩽ 0,25 ampere turns).
If single-phase power rectification is employed in the TV circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.
To ease the mounting of the coils, the rimband is provided with rectangular holes. An example is given below.



Position of degaussing coils on the picture tube.



Degaussing circuit using dual PTC thermistor 2322 662 98009.

Data of each degaussing coil

Circumference	120 cm
Number of turns	50
Copper-wire diameter	0,35 mm
Aluminium-wire diameter	0,45 mm
Resistance	12 Ω

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic bi-potential focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphors featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moire
- Fine pitch over entire screen
- Phosphor lines follow glass contour ←
- Quick-heating cathodes
- Internal magnetic shield
- Reinforced envelope for push-through mounting
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1237), it forms a self-converging assembly; dynamic convergence is not required.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	51 cm
Overall length	424 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	20% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	bi-potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m + m')}$	max. 2300 pF min. 1500 pF
grid 1 to all other electrodes	C_{g1}	15 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

→ Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 480,0 mm
horizontal axis	min. 404,4 mm
vertical axis	min. 303,3 mm
area	min. 1190 cm^2
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,8 mm
Light transmission of face glass at centre	64%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	424 ± 9,5 mm
Neck diameter	$29,1\,^{+1,4}_{-0,7}$ mm *
Bulb dimensions	
diagonal	max. 515,5 mm
width	max. 442,5 mm
height	max. 343,8 mm
Base	12-pin base JEDEC B12-262
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 13 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35g in any direction.

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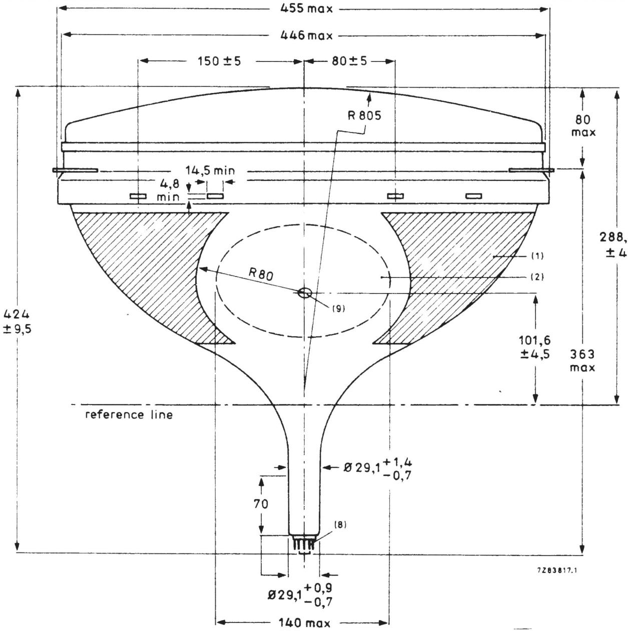
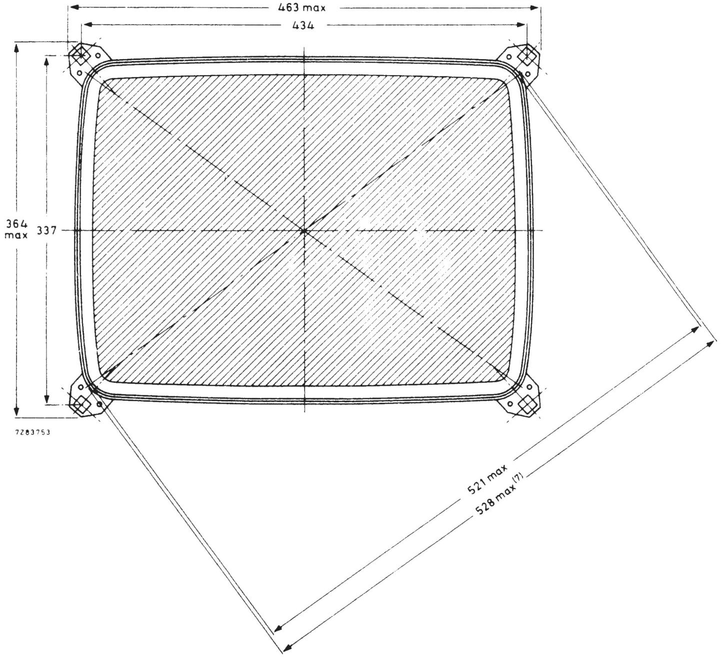
* In the region of 70 mm from the neck end, the maximum diameter is 30 mm.

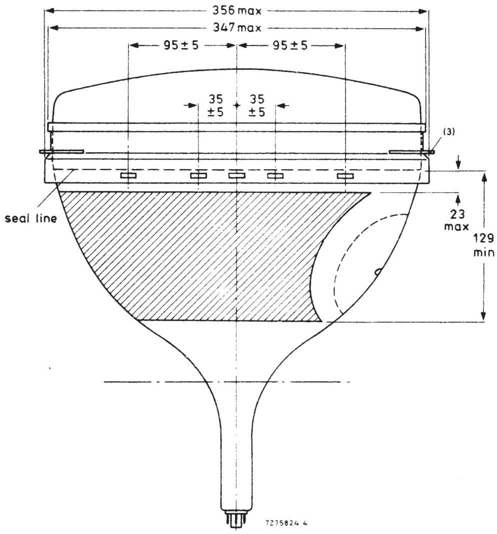
MECHANICAL DATA (continued)

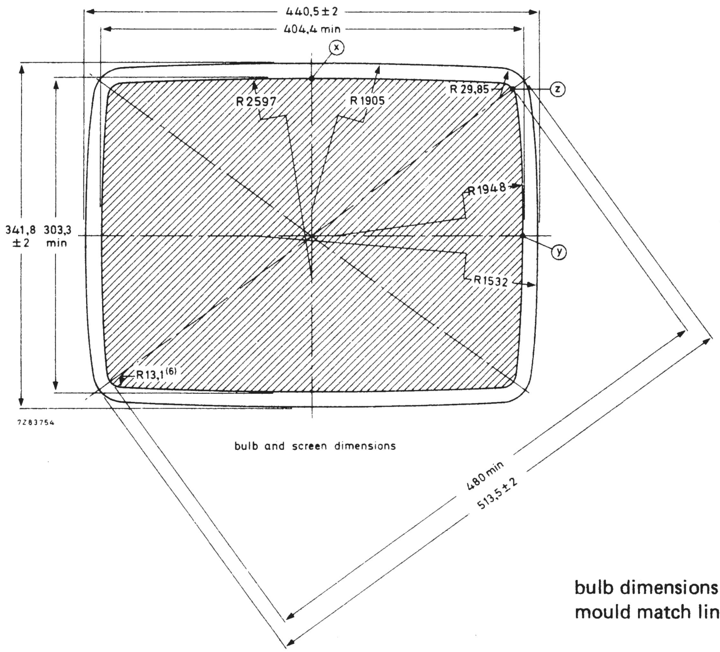
Dimensions in mm

Notes are given after the drawings.


455 max
446 max
150 ± 5
80 ± 5
R 805
80 max
14,5 min
4,8 min
288,8 ± 4
(1)
(2)
R 80
(9)
424 ± 9,5
101,6 ± 4,5
363 max
reference line
Ø 29,1 +1,4 −0,7
70
(8)
7Z83817.1
Ø 29,1 +0,9 −0,7
140 max


463 max
434
364 max
337
7Z83753
521 max
528 max (7)

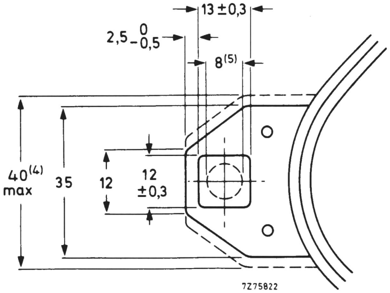

356 max
347 max
95 ± 5
95 ± 5
35 ±5
35 ±5
(3)
seal line
23 max
129 min
7Z75824.4


440,5 ± 2
404,4 min
x
R 2597
R 1905
R 29,85
z
R 1948
341,8 ±2
303,3 min
y
R 1532
R 13,1 (6)
7Z83754
480 min
513,5 ± 2

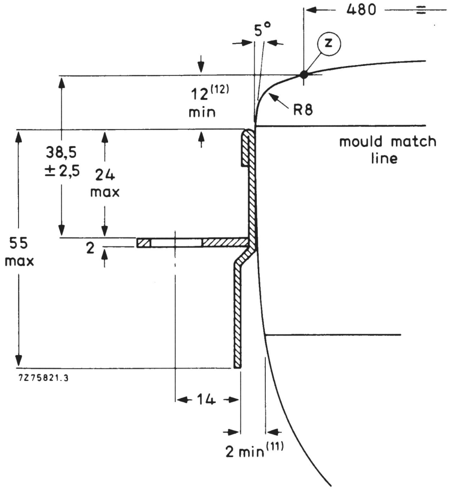
bulb and screen dimensions

bulb dimensions at mould match line

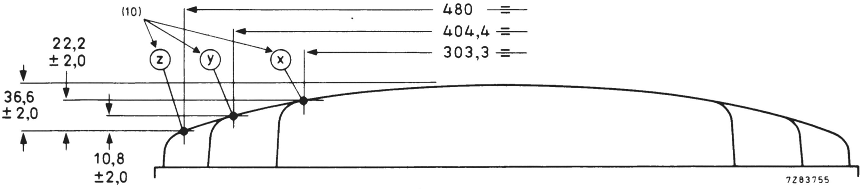
MECHANICAL DATA (continued)



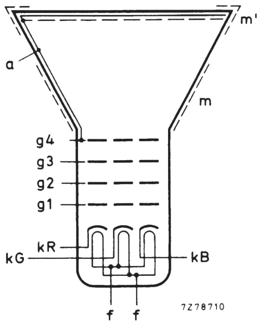
13 ±0,3
2,5 0 −0,5
8(5)
40(4) max
35
12
12 ±0,3
7Z75822



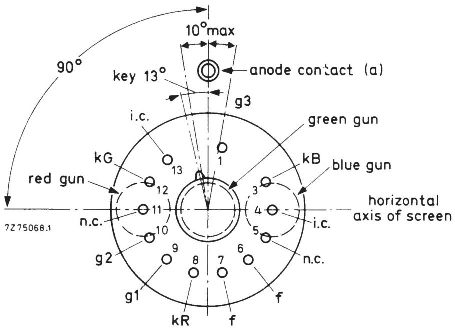
480
5°
z
12(12) min
R8
mould match line
38,5 ±2,5
24 max
55 max
2
14
2 min(11)
7Z75821.3



(10)
480
404,4
303,3
z
y
x
22,2 ±2,0
36,6 ±2,0
10,8 ±2,0
7Z83755



m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710



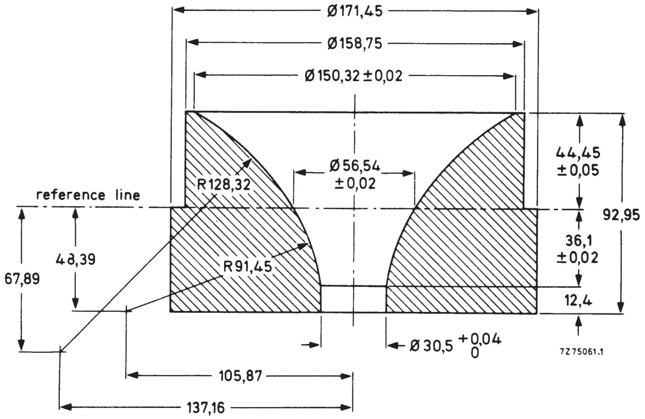
90°
10° max
anode contact (a)
key 13°
g3
i.c.
green gun
kG
13
1
kB
blue gun
red gun
12
3
horizontal axis of screen
11
4
n.c.
10
5
i.c.
g2
9
8
7
6
n.c.
g1
kR
f
f
7Z75068.1

i.c. = internally connected (not to be used)
n.c. = not connected

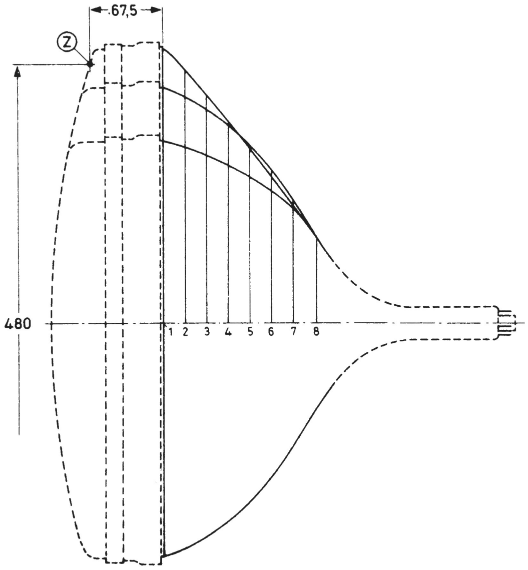
Notes to outline drawings on the preceding pages

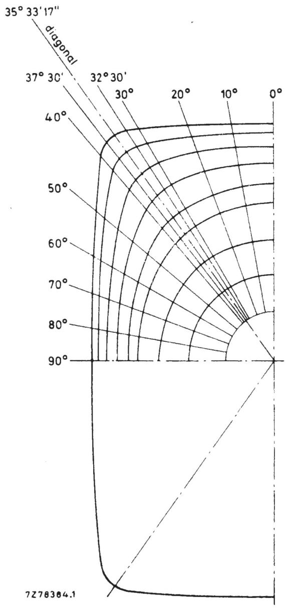
1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 434 mm x 337 mm.
6. Co-ordinates for radius R = 13,1 mm; x = 184,58 mm, y = 131,93 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC 67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.
11. Minimum distance between glass and rimband in plane of centre line apertures.
12. Distance from point z to any handware.

Reference line gauge; GR90CJ4



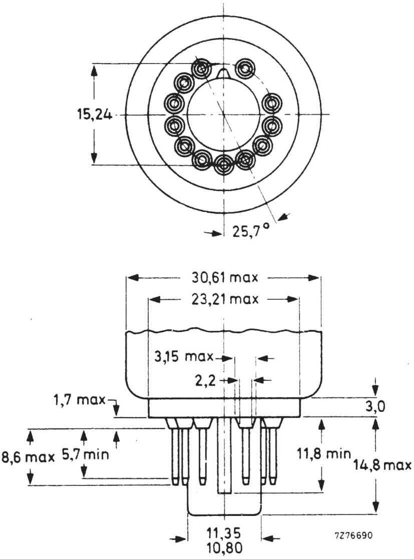
Maximum cone contour

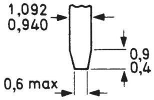




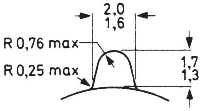
section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30′	diag. axes	37° 30′	40°	45°	50°	60°	70°	80°	90°
1	0	218,7	221,9	231,2	238,5	247,5	252,2	255,9	254,6	247,7	230,1	215,1	193,0	179,2	171,5	169,
2	20	209,8	212,4	220,3	226,0	232,5	235,3	236,5	235,0	230,2	216,9	204,4	184,9	172,3	165,3	163,
3	40	197,5	199,4	204,7	208,1	211,1	211,9	211,4	210,0	207,0	198,6	189,5	173,9	163,2	157,1	155,
4	60	182,2	183,2	185,8	187,1	187,7	187,4	186,4	185,3	183,3	178,2	172,1	160,7	152,4	147,4	145,
5	80	163,2	163,5	163,9	163,7	163,1	162,4	161,4	160,6	159,3	156,3	152,9	145,8	140,1	136,6	135,
6	100	146,1	146,1	145,7	145,1	144,2	143,6	142,8	142,2	141,4	139,5	137,5	133,3	129,7	127,3	126,
7	120	112,3	112,3	111,9	111,7	111,3	111,1	110,9	110,7	110,5	110,0	109,5	108,6	107,8	107,3	107,
8	141,7	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,

12-pin base; JEDEC B12-262


15,24
25,7°
30,61 max
23,21 max
3,15 max
2,2
1,7 max
3,0
8,6 max
5,7 min
11,8 min
14,8 max
11,35
10,80
7Z76690


1,092
0,940
0,9
0,4
0,6 max

pin contour


2,0
1,6
R 0,76 max
R 0,25 max
1,7
1,3

detail of key

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage or voltage	$V_{a, g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,7 to 5,5 kV
Grid 2 voltage for a spot cut-off voltage V_k = 120 V	V_{g2}	310 to 560 V
Luminance at the centre of the screen*	L	170 cd/m^2

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* Tube settings adjusted to produce white of 6500K + 7 M.P.C.D. (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	18,8 to 22% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart *
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs **
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 μA

To produce white of 6500K + 7 M.P.C.D. (CIE co-ordinates x = 0,313, y = 0,329)

Percentage of the total anode current supplied by each gun (typical)

red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 120 V. Increase the V_{g2} from about 300 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

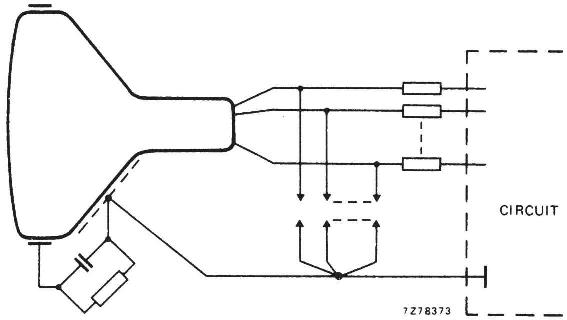
The voltages are specified with respect to grid 1.

Anode voltage	$V_{a, g4}$	max. min.	27,5 kV 20 kV	notes 1, 2 and 3 note 4
Long-term average current for three guns	I_a	max.	1000 μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	7 kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000 V	
Cathode voltage				
positive	V_k	max.	400 V	
positive operating cut-off	V_k	max.	200 V	
negative	$-V_k$	max.	0 V	
negative peak	$-V_{kp}$	max.	2 V	
Heater voltage	V_f	max. min.	7,2 V 5,4 V	note 6
Heater-cathode voltage				
heater negative with respect to cathode				
during equipment warm-ip period not exceeding 15 s	V_{kf}	max.	450 V	note 1
after equipment warm-up period	V_{kf}	max.	250 V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200 V	note 1
	$-V_{kf}$	max.	0 V	
		(d.c. component value)		

Notes
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1500 μA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

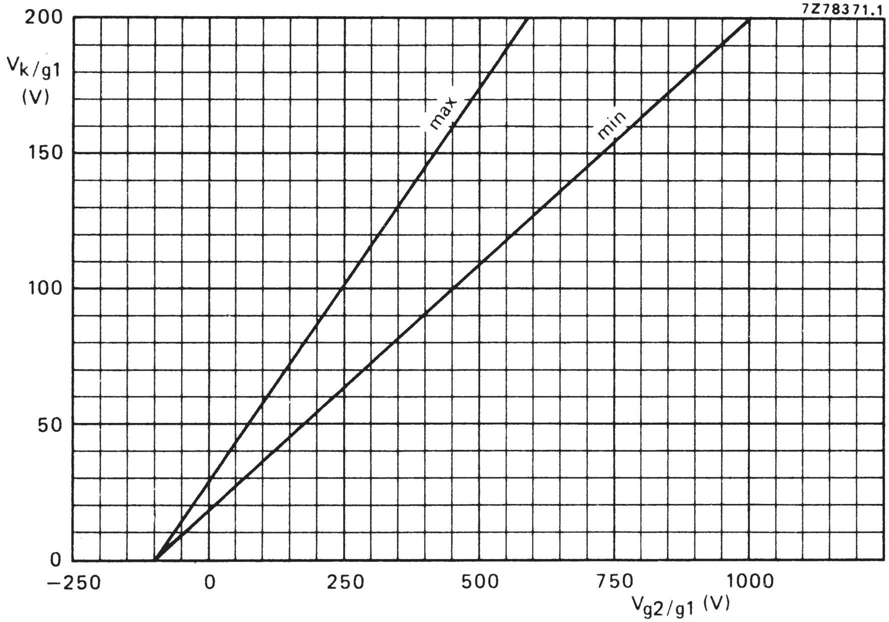
FLASHOVER PROTECTION

With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.
The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 8,5 kV (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.
Additional information is available on request.

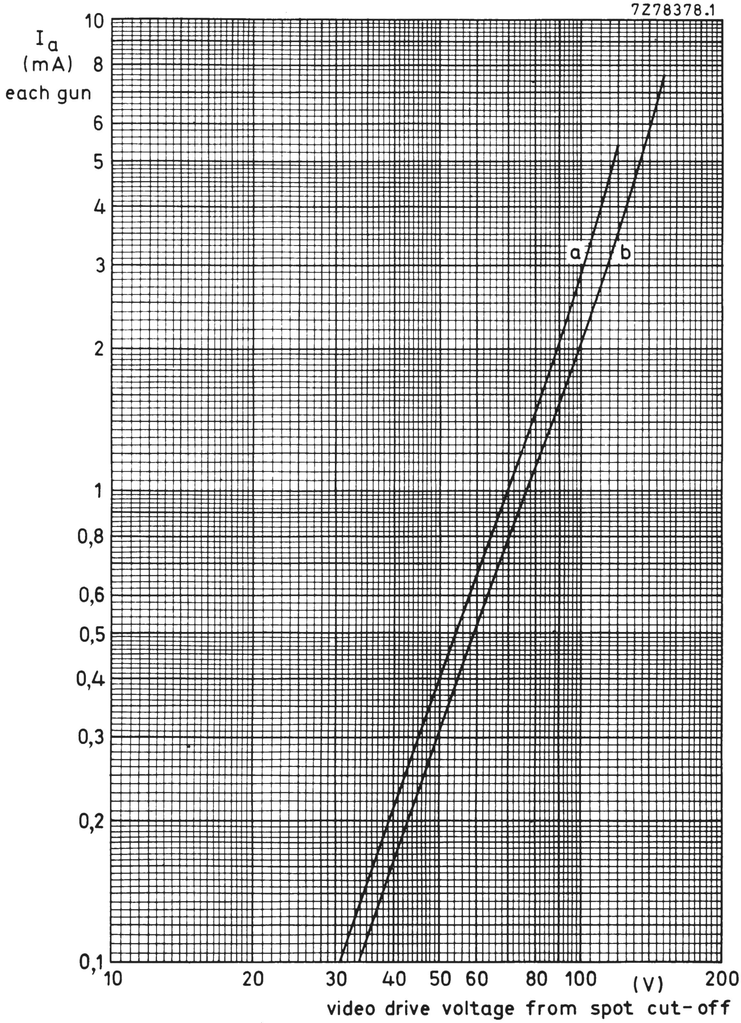


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	5 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2,5 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm



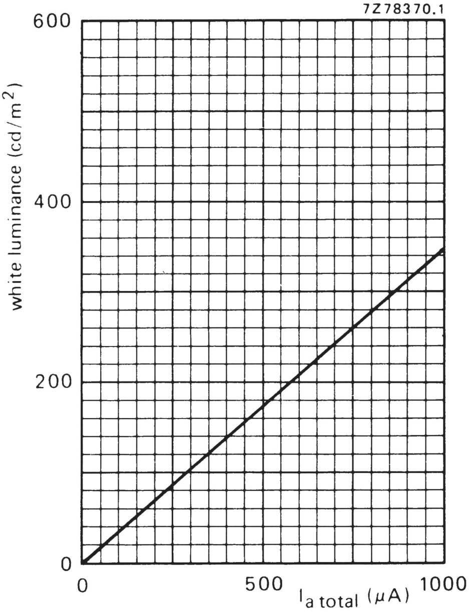
Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,\ g4}$ = 25 kV.



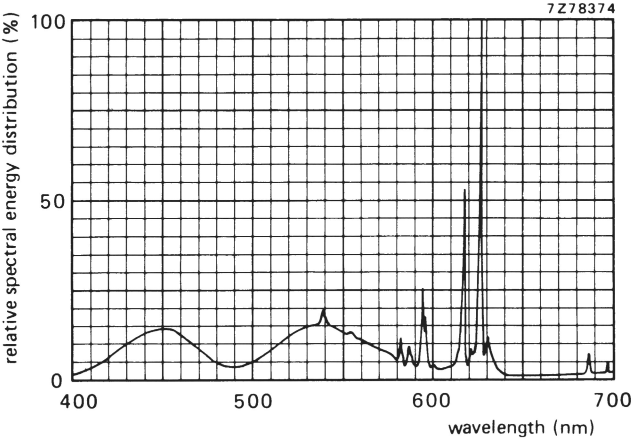
Typical cathode drive characteristics

V_f = 6,3 V;
$V_{a,g4}$ = 25 kV;
V_{g3} adjusted for focus;
V_{g2} adjusted to provide spot cut-off for desired fixed V_K.

curve a = spot cut-off = 120 V;
curve b = spot cut-off = 150 V.

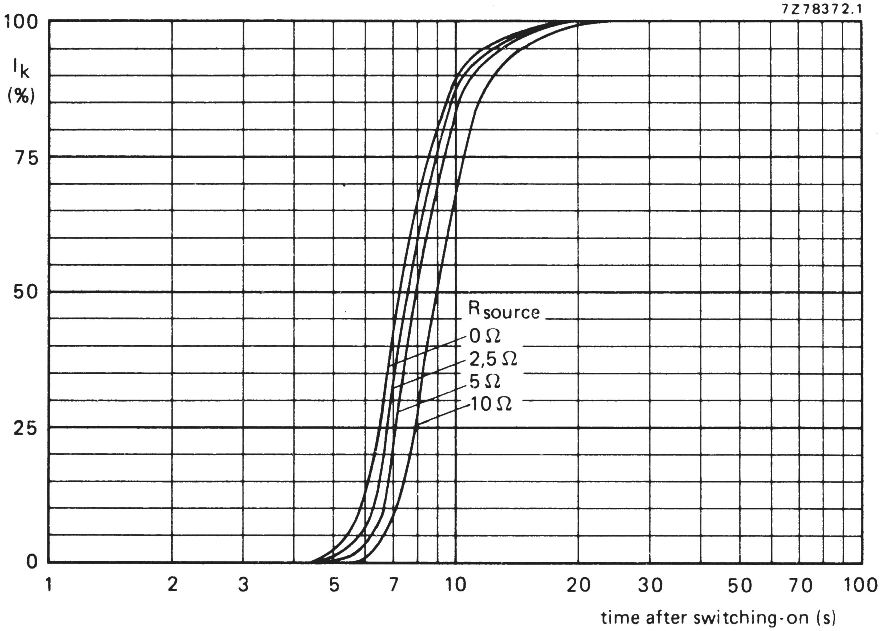


Luminance at the centre of the screen as a function of I_{total}.
$V_{a, g4}$ = 25 kV, V_f = 6,3 V, V_{g3} adjusted for optimum focus.
Scanned area = 404,4 mm x 303,3 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



Cathode heating time after switching on , measured under typical operating conditions.

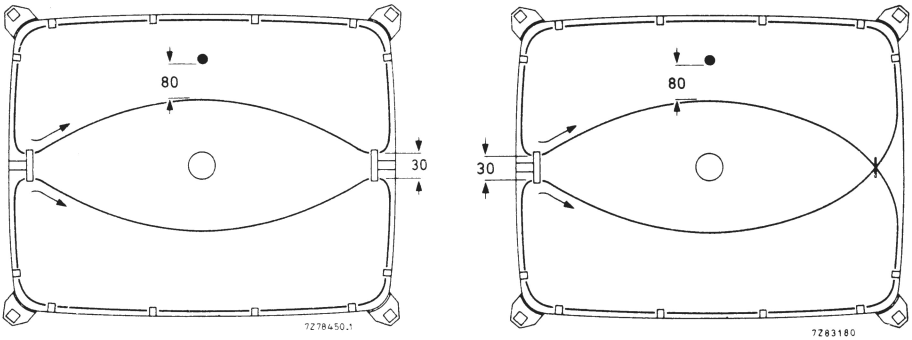
DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic, degaussing system, consisting of two coils covering top and bottom cone parts, or one large coil shaped in the form of a figure eight, with one half on the top and the other half on the bottom cone part.

For proper degaussing an initial magnetomotive force (m.m.f.) of 300 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coils (≤ 0,3 ampere-turns).

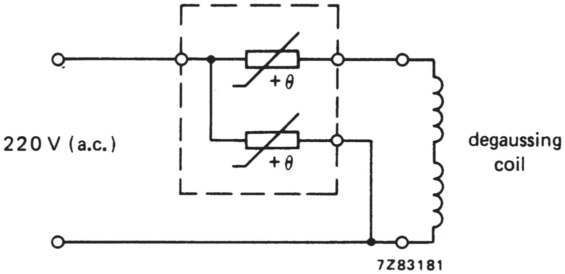
If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.

Examples of a double-coil and of a single-coil system are given below.



Position of degaussing coils on the picture tube.

Degaussing circuit using dual PTC thermistor.



Data of each degaussing coil

	double-coil system	single-coil system
Circumference	117 cm	237 cm
Number of turns	60	60
Copper-wire diameter	0,35 mm	0,35 mm
Resistance (R_c)	12,5 Ω	25,1 Ω
Catalogue number of appropriate dual PTC thermistor	2322 662 98009	2322 662 98009

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic hi-bi potential for improved focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphors featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Reinforced envelope for push-through mounting
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1237), it forms a self-converging assembly; dynamic convergence is not required.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	51 cm
Overall length	436 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external		max. 2300 pF
conductive coating including rimband	$C_{a(m + m')}$	min. 1500 pF
grid 1 to all other electrodes	C_{g1}	17 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 480,0 mm
horizontal axis	min. 404,4 mm
vertical axis	min. 303,3 mm
area	min. 1190 cm^2
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,8 mm
Light transmission of face glass at centre	64%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	436,2 ± 5 mm
Neck diameter	$29,1\,^{+1,4}_{-0,7}$ mm*
Bulb dimensions	
diagonal	max. 515,5 mm
width	max. 442,5 mm
height	max. 343,8 mm
Base	10-pin base JEDEC B10-277
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 13 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35g in any direction.

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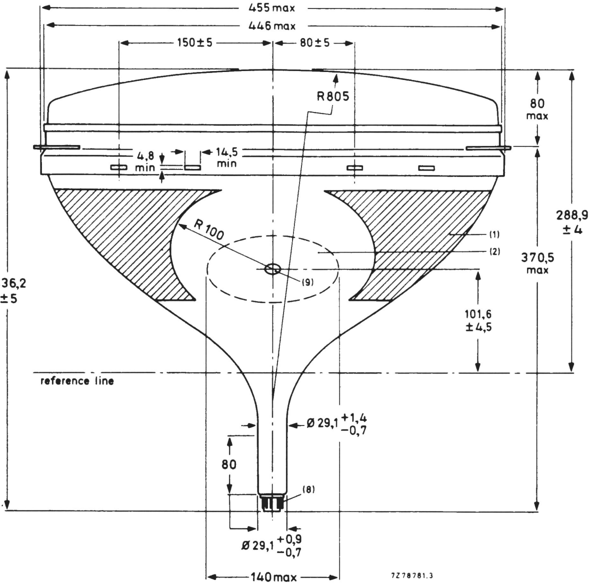
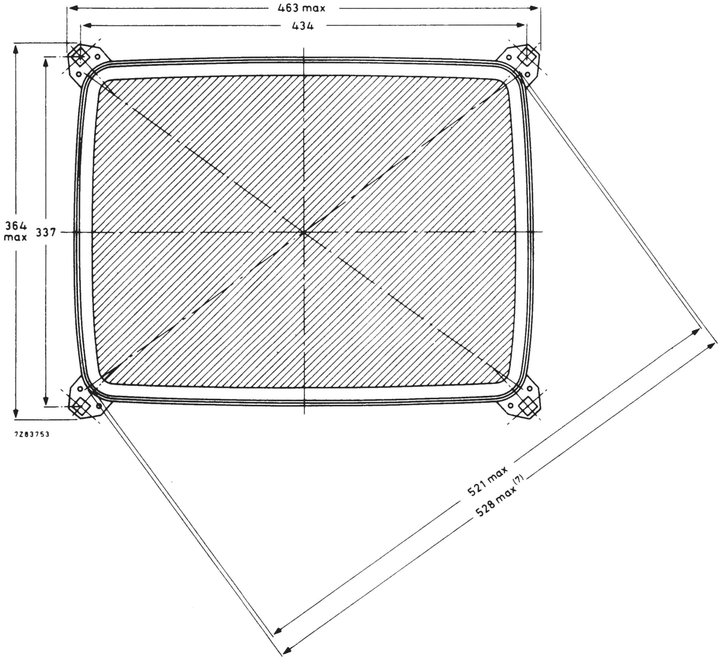
* In the region of 80 mm from the neck end, the maximum diameter is 30 mm.

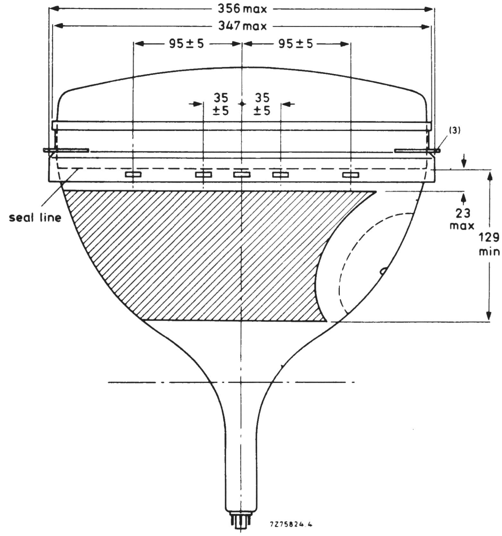
MECHANICAL DATA (continued)

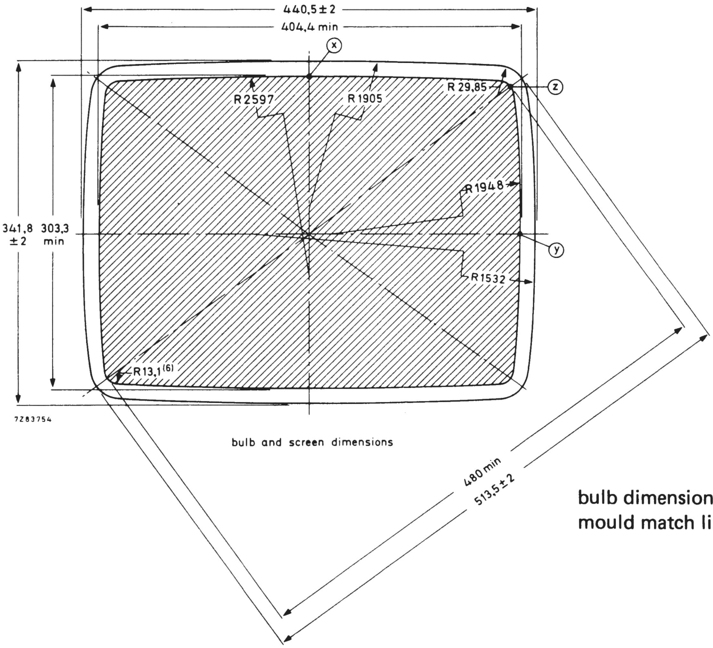
Dimensions in mm

Notes are given after the drawings.


455 max
446 max
150 ± 5
80 ± 5
R805
80
max
4,8
min
14,5
min
288,9
± 4
R 100
(1)
(2)
370,5
max
436,2
± 5
(9)
101,6
± 4,5
reference line
Ø 29,1 +1,4 −0,7
80
(8)
Ø 29,1 +0,9 −0,7
140 max
7Z78781.3


463 max
434
364
max
337
7Z83753
521 max
528 max (7)

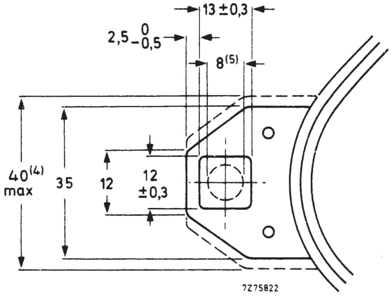

356 max
347 max
95 ± 5
95 ± 5
35 ±5
35 ±5
(3)
seal line
23 max
129 min
7Z75824.4

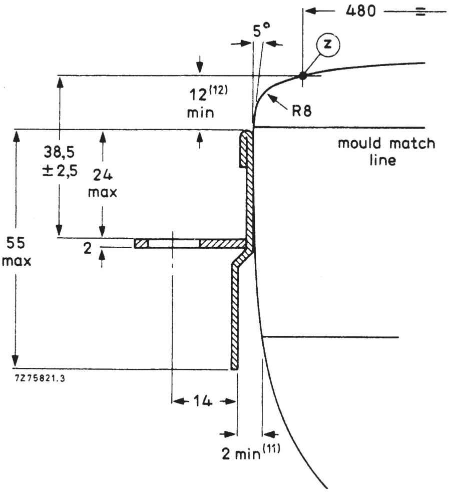

440,5 ± 2
404,4 min
x
R 2597
R 1905
R 29,85
z
R 1948
341,8 ± 2
303,3 min
y
R 1532
R 13,1(6)
7Z83754
480 min
513,5 ± 2

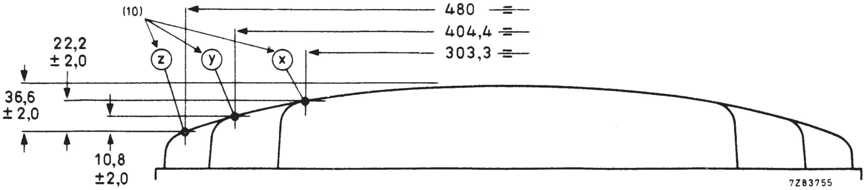
bulb and screen dimensions

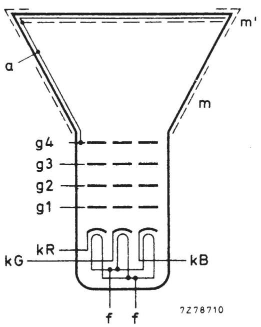
bulb dimensions at mould match line

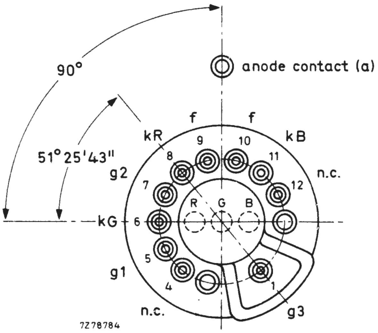
MECHANICAL DATA (continued)


13 ±0,3
2,5 $^{0}_{-0,5}$
8(5)
40(4) max
35
12
12 ±0,3
7Z75822


480
5°
z
12(12) min
R8
mould match line
38,5 ±2,5
24 max
55 max
2
14
2 min(11)
7Z75821.3


(10)
480
404,4
303,3
z
y
x
22,2 ± 2,0
36,6 ± 2,0
10,8 ±2,0
7Z83755


m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

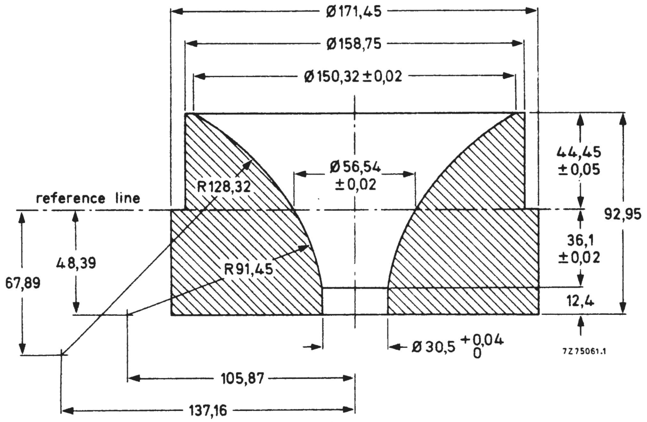

90°
anode contact (a)
51°25'43"
f
f
kR
kB
9
10
8
11
g2
n.c.
7
12
R
G
B
kG
6
5
g1
4
1
n.c.
g3
7Z78784

n.c. = not connected.

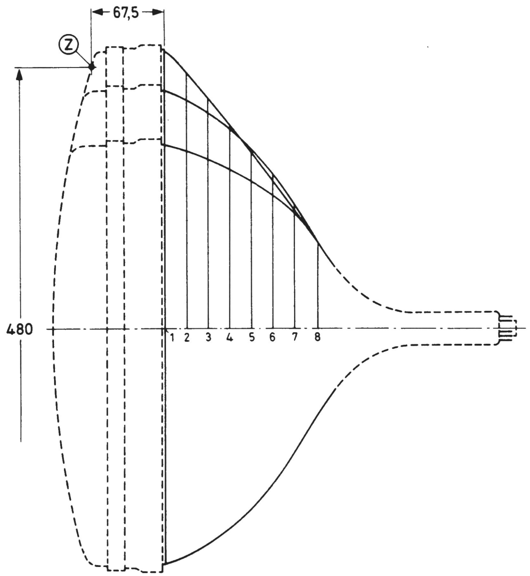
Notes to outline drawings on the preceding pages

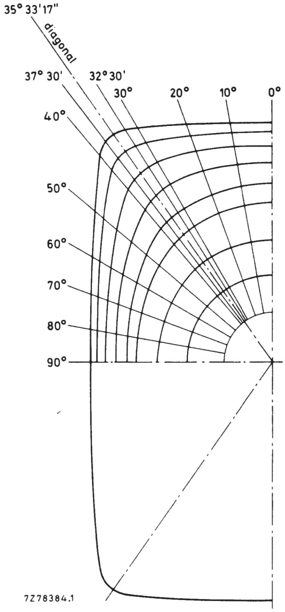
1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 434 mm x 337 mm.
6. Co-ordinates for radius R = 13,1 mm: x = 184,58 mm, y = 131,93 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC 67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.
11. Minimum distance between glass and rimband in plane of centre line apertures.
12. Distance from point z to any hardware.

Reference line gauge; GR90CJ4



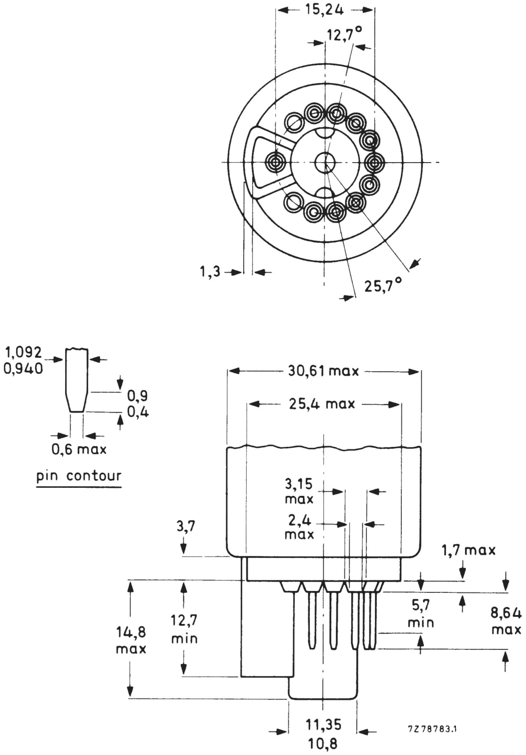
Maximum cone contour





section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30'	diag. axes	37° 30'	40°	45°	50°	60°	70°	80°	90°
1	0	218,7	221,9	231,2	238,5	247,5	252,2	255,9	254,6	247,7	230,1	215,1	193,0	179,2	171,5	169,0
2	20	209,8	212,4	220,3	226,0	232,5	235,3	236,5	235,0	230,2	216,9	204,4	184,9	172,3	165,3	163,0
3	40	197,5	199,4	204,7	208,1	211,1	211,9	211,4	210,0	207,0	198,6	189,5	173,9	163,2	157,1	155,1
4	60	182,2	183,2	185,8	187,1	187,7	187,4	186,4	185,3	183,3	178,2	172,1	160,7	152,4	147,4	145,8
5	80	163,2	163,5	163,9	163,7	163,1	162,4	161,4	160,6	159,3	156,3	152,9	145,8	140,1	136,6	135,4
6	100	146,1	146,1	145,7	145,1	144,2	143,6	142,8	142,2	141,4	139,5	137,5	133,3	129,7	127,3	126,5
7	120	112,3	112,3	111,9	111,7	111,3	111,1	110,9	110,7	110,5	110,0	109,5	108,6	107,8	107,3	107,1
8	141,7	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8

10-pin base; JEDEC B10-277


15,24
12,7°
1,3
25,7°
1,092
0,940
0,9
0,4
0,6 max
pin contour
30,61 max
25,4 max
3,15 max
2,4 max
3,7
1,7 max
5,7 min
8,64 max
14,8 max
12,7 min
11,35
10,8
7Z78783.1

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,6 to 7,5	kV
Grid 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	390 to 760	V
Luminance at the centre of the screen*	L	170	cd/m^2

---

* Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26,6 to 29,8% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart*
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs**
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 μA

To produce white D, CIE co-ordinates x = 0,313, y = 0,329.

Percentage of the total anode current supplied by each gun (typical)	
red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 140 V. Increase the V_{g2} from about 400 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

The voltages are specified with respect to grid 1.

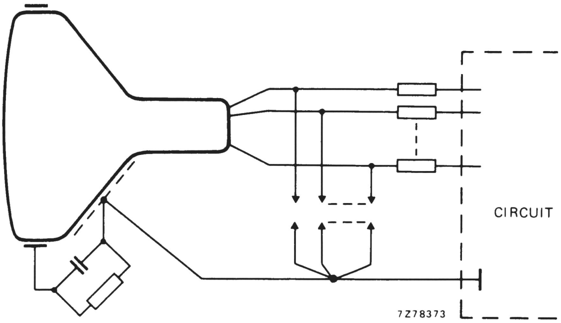
Anode voltage	$V_{a, g4}$	max.	27,5 kV	notes 1, 2 and 3
		min.	20 kV	note 4
Long-term average current for three guns	I_a	max.	1000 µA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	11 kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000 V	
Cathode voltage				
positive	V_k	max.	400 V	
positive operating cut-off	V_k	max.	200 V	
negative	$-V_k$	max.	0 V	
negative peak	$-V_{kp}$	max.	2 V	
Heater voltage	V_f	max.	7,2 V	note 6
		min.	5,4 V	
Heater-cathode voltage				
heater negative with respect to cathode				
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450 V	note 1
after equipment warm-up period	V_{kf}	max.	250 V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200 V	note 1
	$-V_{kf}$	max.	0 V (d.c. component value)	

Notes

1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerable. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1500 µA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

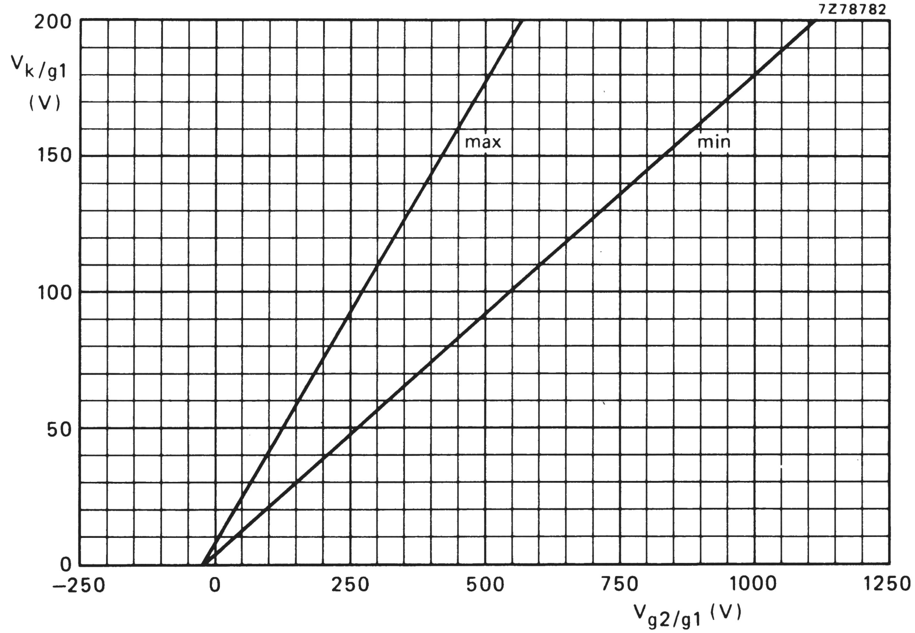
FLASHOVER PROTECTION

With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.
The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 11,5 kV (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.
Additional information is available on request.

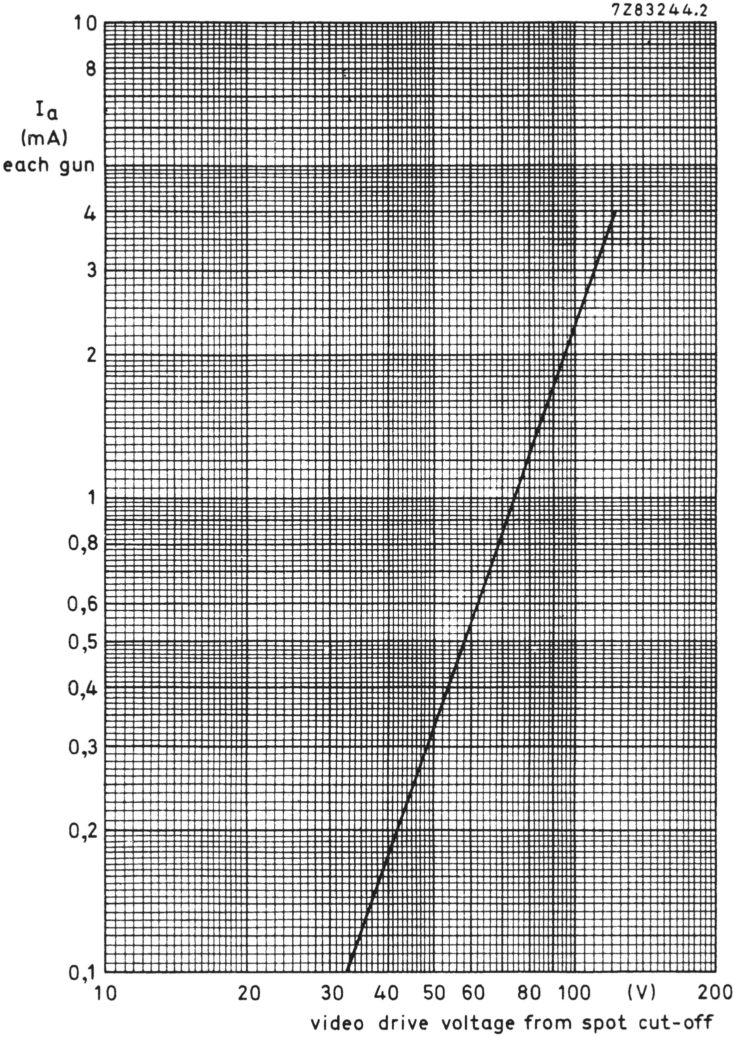


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	5 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2,5 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm

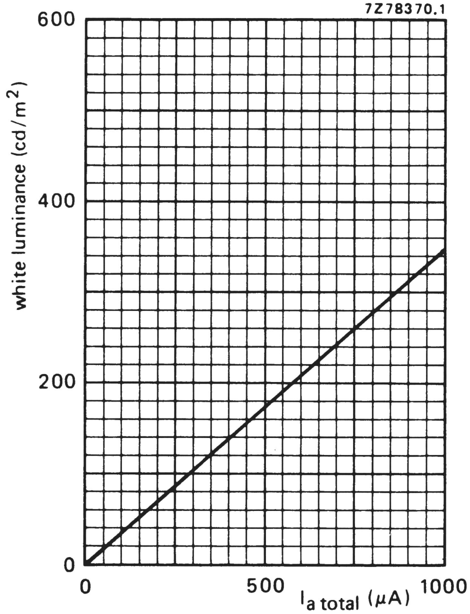


Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.

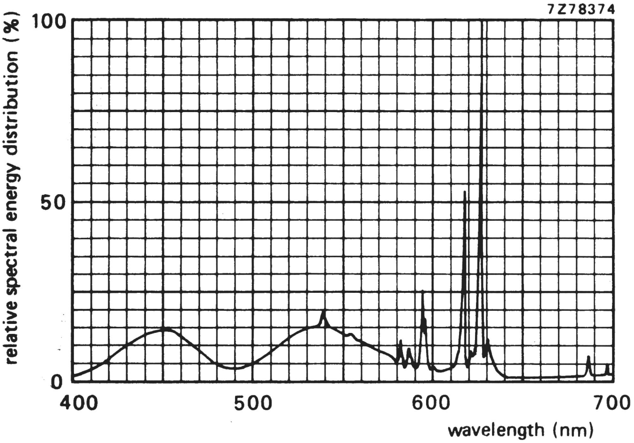


Typical cathode drive characteristics

V_f = 6,3 V
$V_{a,g4}$ = 25 kV
V_{g3} adjusted for focus
V_{g2} adjusted to provide spot
cut-off for V_K = 140 V

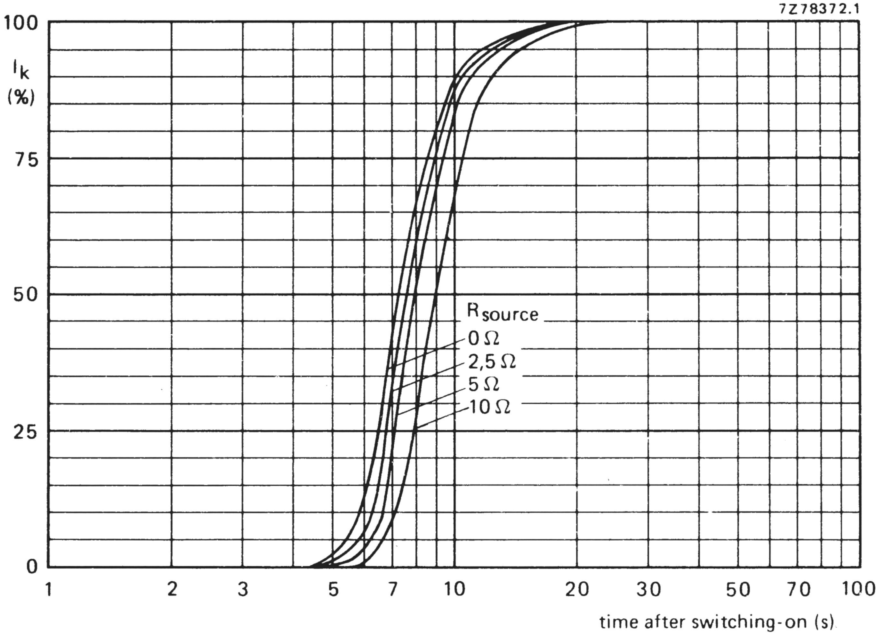


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV.
Scanned area = 404,4 mm x 303,3 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060

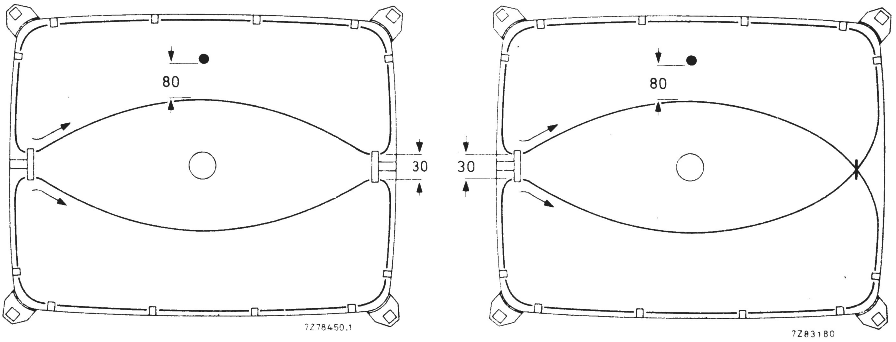


Cathode heating time after switching on, measured under typical operating conditions.

DEGAUSSING

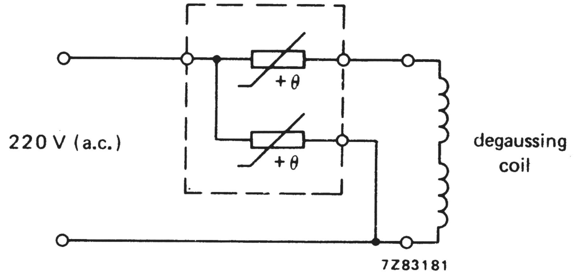
The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts, or one large coil shaped in the form of a figure eight, with one half on the top and the other half on the bottom cone part.
For proper degaussing an initial magnetomotive force (m.m.f.) of 300 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coils ($\leqslant$ 0,3 ampere-turns).
If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.

Examples of a double-coil and of a single-coil system are given below.



Position of degaussing coils on the picture tube.

Degaussing circuit using dual PTC thermistor.



Data of each degaussing coil

	double-coil system	single-coil system
Circumference	117 cm	237 cm
Number of turns	60	60
Copper-wire diameter	0,35 mm	0,35 mm
Resistance (R_C)	12,5 Ω	25,1 Ω
Catalogue number of appropriate dual PTC thermistor	2322 662 98009	2322 662 98009

Hi-Bri COLOUR PICTURE TUBE

- 90° deflection
- In-line gun, electrostatic hi-bi potential for improved focus
- 29,1 mm neck diameter
- Hi-Bri screen with pigmented phosphors featuring high brightness and increased contrast performance
- Soft-Flash technology offering improved set reliability
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Phosphor lines follow glass contour
- Quick-heating cathodes
- Internal magnetic shield
- Reinforced envelope for push-through mounting
- When combined with an appropriate hybrid saddle toroidal deflection unit (e.g. AT1236 or AT1480), it forms a self-converging and raster correction free assembly.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	51 cm
Overall length	436 mm
Neck diameter	29,1 mm
Heating	6,3 V, 685 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	unitized triple-aperture electrodes
Focusing method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 60°

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 2300 pF min. 1500 pF
grid 1 to all other electrodes	C_{g1}	17 pF
cathode of each gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	6 pF
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	685 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 480,0 mm
horizontal axis	min. 404,4 mm
vertical axis	min. 303,3 mm
area	min. 1190 cm^2
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type
Centre-to-centre distance of vertical identical colour phosphor stripes, at screen centre	0,8 mm
Light transmission of face glass at centre	64%

MECHANICAL DATA (see also the figures on the following pages)

Overall length	436,2 ± 5 mm
Neck diameter	$29{,}1\,^{+1{,}4}_{-0{,}7}$ mm*
Bulb dimensions	
diagonal	max. 515,5 mm
width	max. 442,5 mm
height	max. 343,8 mm
Base	10-pin base JEDEC B10-277
Anode contact	small cavity contact J1-21, IEC 67-III-2
Mounting position	anode contact on top
Net mass	approx. 13 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 35g in any direction.

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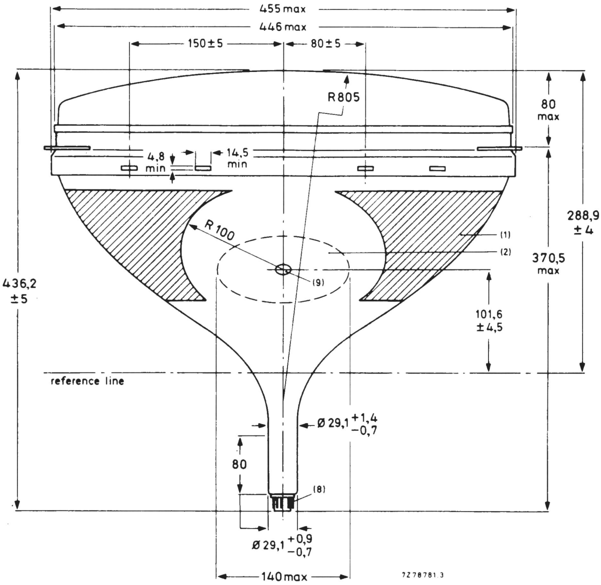
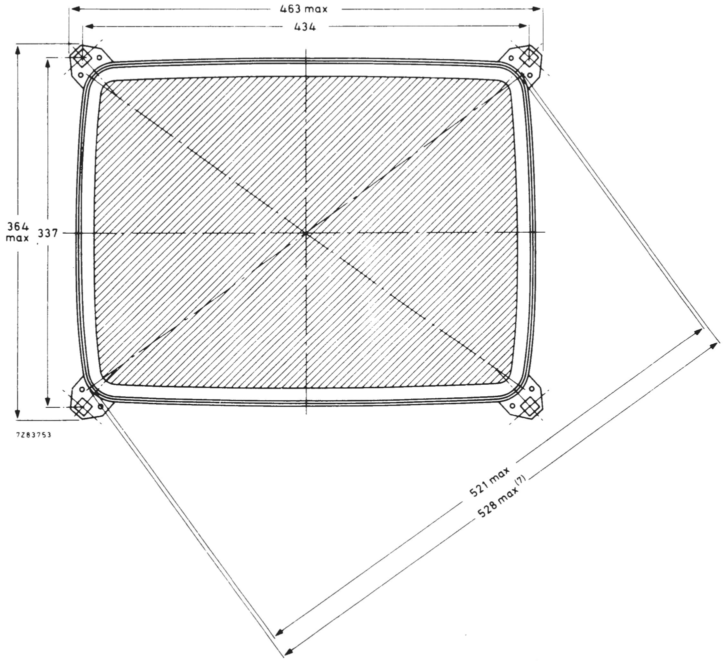
* In the region of 80 mm from the neck end, the maximum diameter is 30 mm.

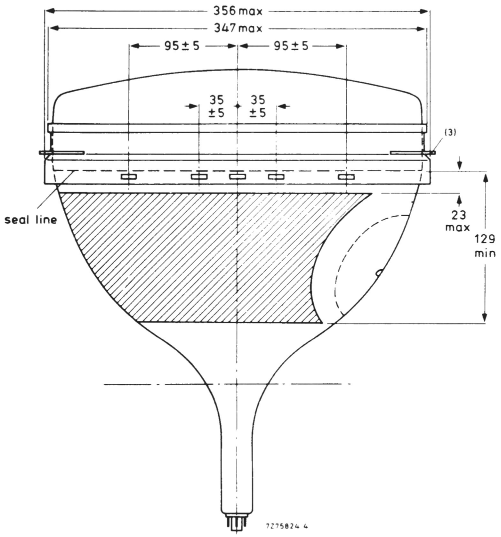
MECHANICAL DATA (continued)

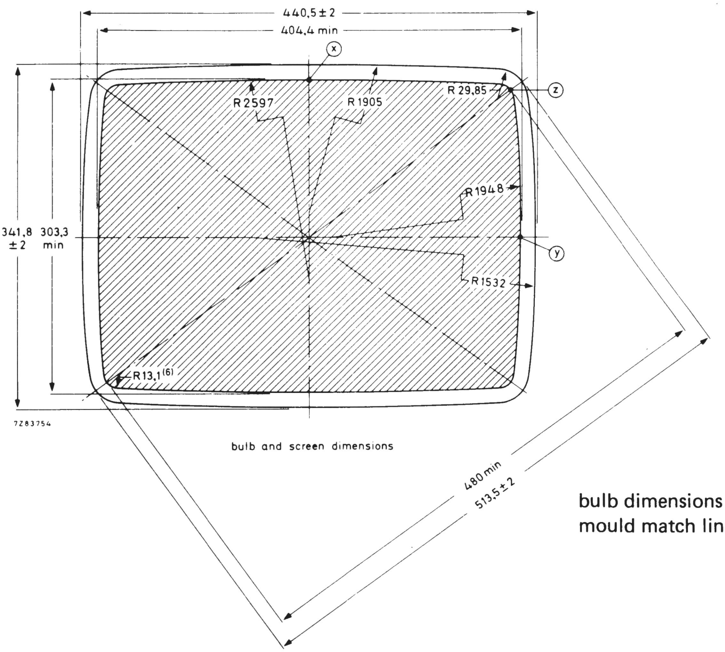
Dimensions in mm

Notes are given after the drawings.


455 max
446 max
150 ± 5
80 ± 5
R805
80 max
4,8 min
14,5 min
R 100
(1)
(2)
(9)
288,9 ± 4
370,5 max
436,2 ± 5
101,6 ± 4,5
reference line
Ø 29,1 +1,4 −0,7
80
(8)
Ø 29,1 +0,9 −0,7
140 max
7Z78781.3


463 max
434
364 max
337
7Z83753
521 max
528 max (7)

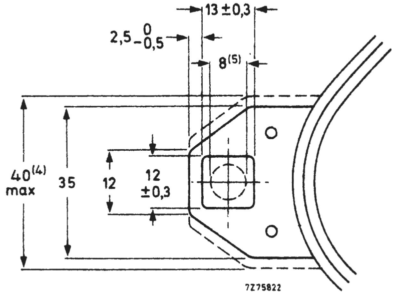

356 max
347 max
95 ± 5
95 ± 5
35 ±5
35 ±5
(3)
seal line
23 max
129 min
7Z75824.4

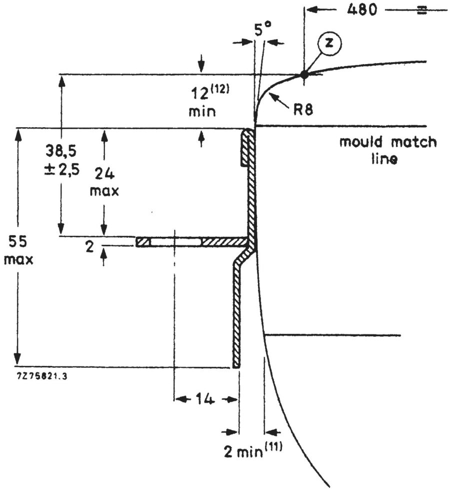

440,5 ± 2
404,4 min
x
R 2597
R 1905
R 29,85
z
R 1948
341,8 ±2
303,3 min
y
R 1532
R 13,1 (6)
7Z83754
480 min
513,5 ± 2

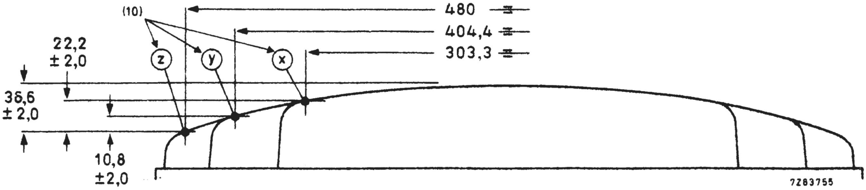
bulb and screen dimensions

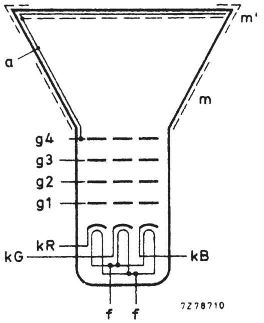
bulb dimensions at mould match line

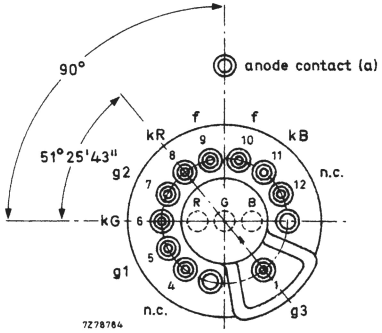
MECHANICAL DATA (continued)


13 ±0,3
2,5 0 −0,5
8(5)
40(4) max
35
12
12 ±0,3
7Z75822


480
5°
z
12(12) min
R8
mould match line
38,5 ±2,5
24 max
55 max
2
14
2 min(11)
7Z75821.3


(10)
480
404,4
303,3
z
y
x
22,2 ±2,0
36,6 ±2,0
10,8 ±2,0
7Z83755


m'
a
m
g4
g3
g2
g1
kR
kG
kB
f
f
7Z78710

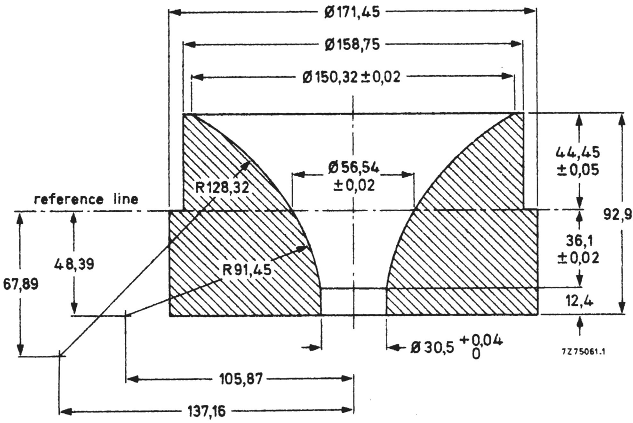

90°
anode contact (a)
51°25'43"
kR
f
f
kB
g2
n.c.
kG
g1
n.c.
g3
R
G
B
1
4
5
6
7
8
9
10
11
12
7Z78784

n.c. = not connected.

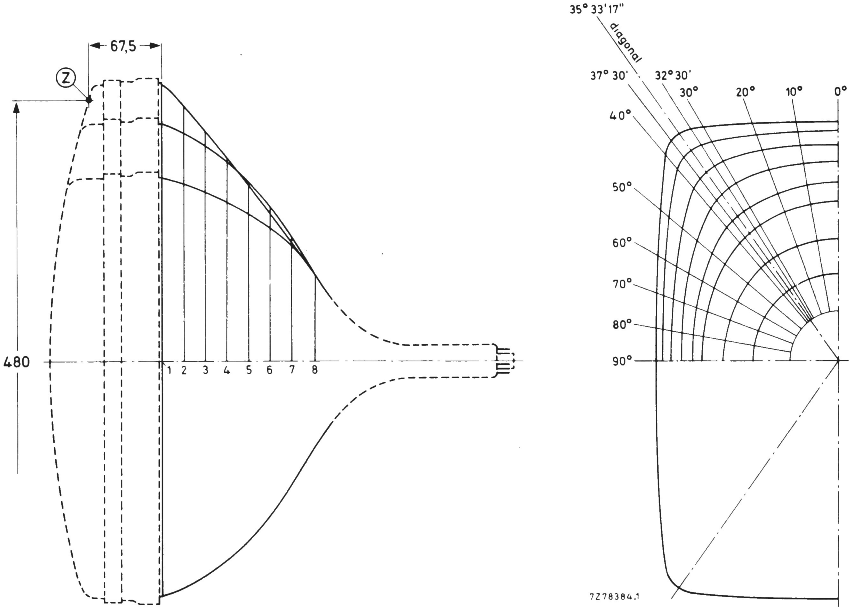
Notes to outline drawings on the preceding pages

1. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
2. To clean this area, wipe only with a soft lintless cloth.
3. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
4. Minimum space to be reserved for mounting lug.
5. The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 434 mm x 337 mm.
6. Co-ordinates for radius R = 13,1 mm: x = 184,58 mm, y = 131,93 mm.
7. Maximum dimensions in plane of lugs.
8. The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 50 mm.
9. Small cavity contact J1-21, IEC 67-III-2.
10. The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively, with the minimum published screen.
11. Minimum distance between glass and rimband in plane of centre line apertures.
12. Distance from point z to any hardware.

Reference line gauge; GR90CJ4

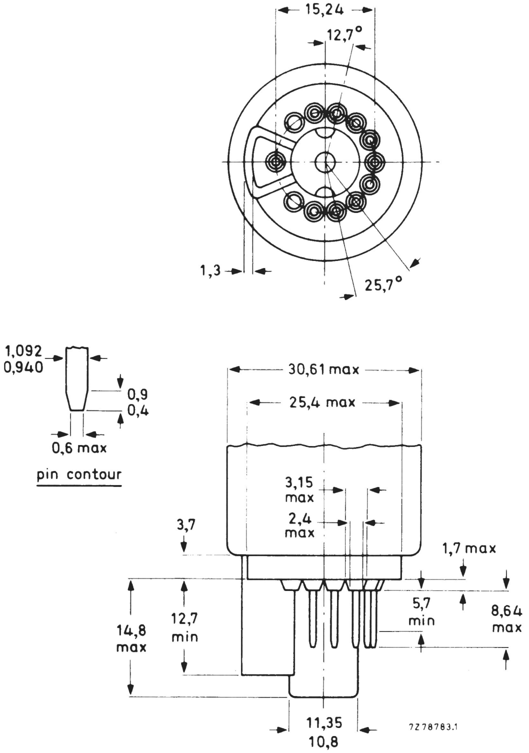


Maximum cone contour



section	nom. distance from section 1	distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30'	diag. axes	37° 30'	40°	45°	50°	60°	70°	80°	90°
1	0	218,7	221,9	231,2	238,5	247,5	252,2	255,9	254,6	247,7	230,1	215,1	193,0	179,2	171,5	169,0
2	20	209,8	212,4	220,3	226,0	232,5	235,3	236,5	235,0	230,2	216,9	204,4	184,9	172,3	165,3	163,0
3	40	197,5	199,4	204,7	208,1	211,1	211,9	211,4	210,0	207,0	198,6	189,5	173,9	163,2	157,1	155,1
4	60	182,2	183,2	185,8	187,1	187,7	187,4	186,4	185,3	183,3	178,2	172,1	160,7	152,4	147,4	145,8
5	80	163,2	163,5	163,9	163,7	163,1	162,4	161,4	160,6	159,3	156,3	152,9	145,8	140,1	136,6	135,4
6	100	146,1	146,1	145,7	145,1	144,2	143,6	142,8	142,2	141,4	139,5	137,5	133,3	129,7	127,3	126,5
7	120	112,3	112,3	111,9	111,7	111,3	111,1	110,9	110,7	110,5	110,0	109,5	108,6	107,8	107,3	107,1
8	141,7	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8	79,8

10-pin base; JEDEC B10-277


15,24
12,7°
1,3
25,7°
1,092
0,940
0,9
0,4
0,6 max
pin contour
30,61 max
25,4 max
3,15 max
2,4 max
3,7
1,7 max
5,7 min
8,64 max
14,8 max
12,7 min
11,35
10,8
7Z78783.1

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,6 to 7,5	kV
Grid 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	390 to 760	V
Luminance at the centre of the screen*	L	175	cd/m^2

---

* Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26,6 to 29,8% of anode voltage
Grid 2 voltage and cathode voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart*
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value > 80% of highest value
Video drive characteristics		see graphs**
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current under cut-off conditions	I_{g1}	−5 to + 5 μA

To produce white D, CIE co-ordinates x = 0,313, y = 0,329.

Percentage of the total anode current supplied by each gun (typical)

red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

---

* The common V_{g2} should be adjusted as follows:
Set the cathode voltage, V_k, for each gun at 140 V. Increase the V_{g2} from about 400 V to the value at which the raster of one of the guns becomes just visible. Now decrease the V_k of the remaining guns so that the rasters of these guns also become visible.

** For optimum picture performance it is recommended that the cathodes are not driven below + 10 V.

LIMITING VALUES (Design maximum rating system unless otherwise stated)

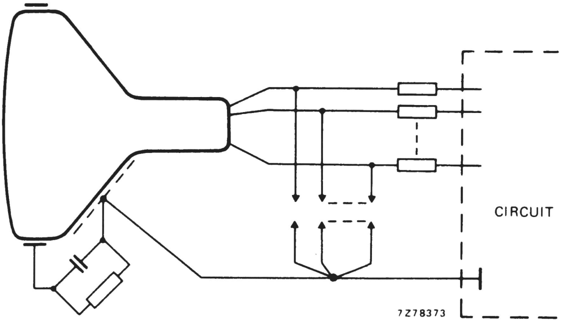
The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,\,g4}$	max.	27,5	kV	notes 1, 2 and 3
		min.	20	kV	note 4
Long-term average current for three guns	I_a	max.	1000	μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	11	kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000	V	
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Heater voltage	V_f	max.	7,2	V	note 6
		min.	5,4	V	
Heater-cathode voltage					
heater negative with respect to cathode					
during equipment warm-up period not exceeding 15 s	V_{kf}	max.	450	V	note 1
after equipment warm-up period	V_{kf}	max.	250	V	
heater positive with respect to cathode	$-V_{kfp}$	peak	200	V	note 1
	$-V_{kf}$	max.	0	V	
		(d.c. component value)			

Notes
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerable. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution.
5. The short-term average anode current should be limited by circuitry to 1500 μA.
6. For maximum cathode life and optimum performance, it is recommended that the heater supply be regulated at 6,3 V.

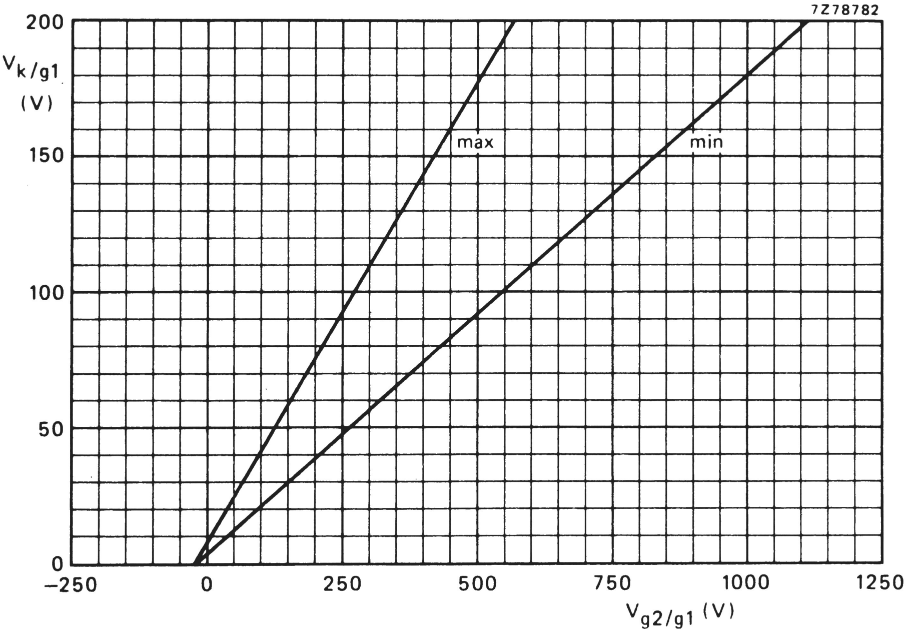
FLASHOVER PROTECTION

With the high voltage used with this tube (max. 27,5 kV) internal flashovers may occur. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible.
The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 11,5 kV (1,5 x V_{g3} max. at $V_{a,g4}$ = 25 kV), and at the other electrodes of 1,5 to 2 kV.
The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.
Additional information is available on request.

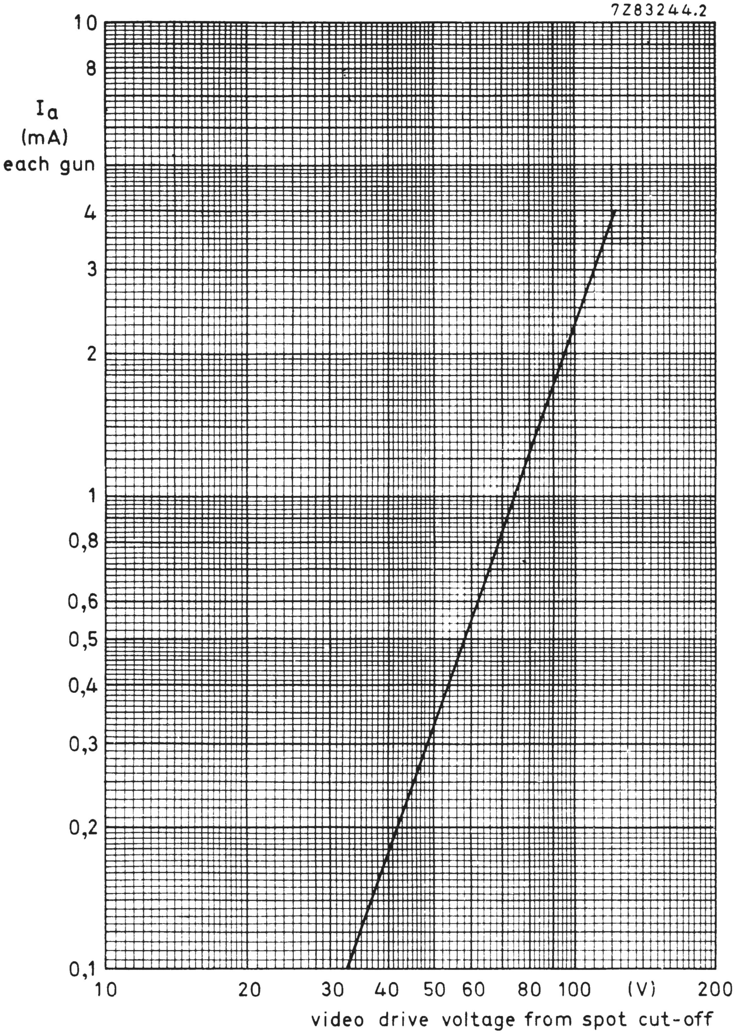


BEAM CORRECTIONS

Maximum required correction for register, as measured at the centre of the screen in any direction	0,08 mm
Displacements, measured at centre of screen	
centre convergence displacement in any direction of the blue and red beams	5 mm
centre convergence displacement in any direction between green beam and converged blue and red beams	2,5 mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction, measured with deflection coils in nominal position	5 mm

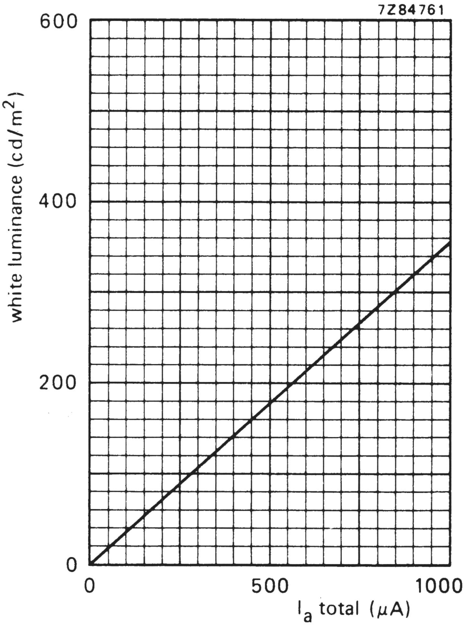


Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.

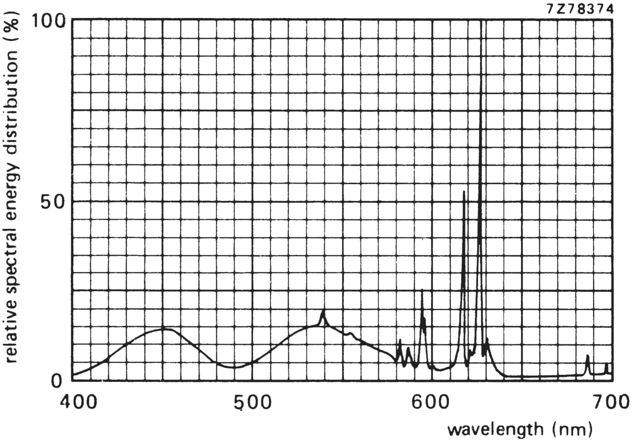


Typical cathode drive characteristics

V_f = 6,3 V
$V_{a,g4}$ = 25 kV
V_{g3} adjusted for focus
V_{g2} adjusted to provide spot
cut-off for V_K = 140 V

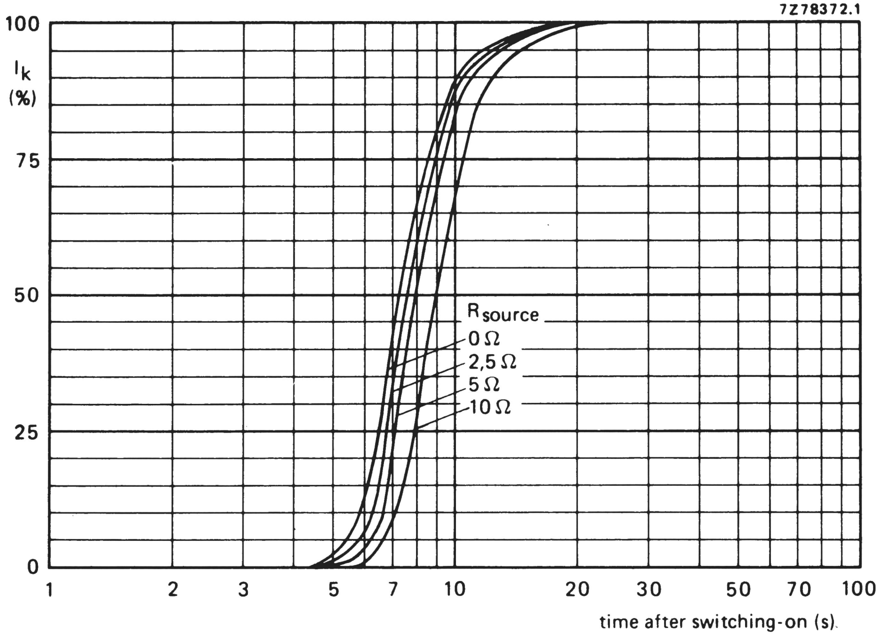


Luminance at the centre of the screen as a function of I_{total}.
$V_{a,g4}$ = 25 kV.
Scanned area = 404,4 mm x 303,3 mm;
CIE co-ordinates x = 0,313, y = 0,329.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060

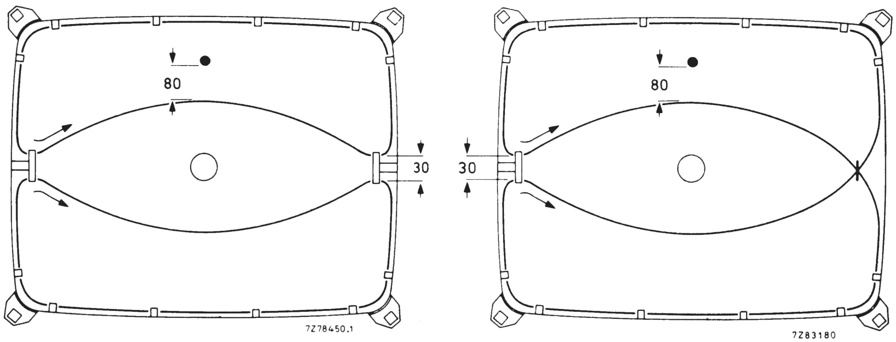


Cathode heating time after switching on, measured under typical operating conditions.

DEGAUSSING

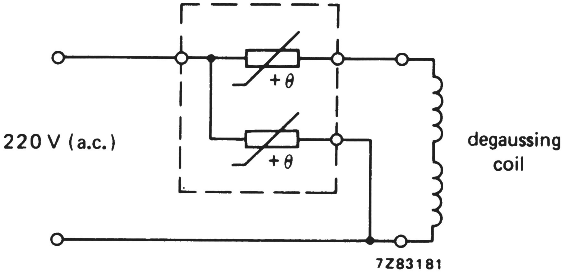
The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts, or one large coil shaped in the form of a figure eight, with one half on the top and the other half on the bottom cone part.
For proper degaussing an initial magnetomotive force (m.m.f.) of 300 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate degaussing circuitry. In the steady state, no significant m.m.f. should remain in the coils ($\leqslant$ 0,3 ampere-turns).
If single-phase power rectification is employed in the t.v. circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.

Examples of a double-coil and of a single-coil system are given below.



Position of degaussing coils on the picture tube.

Degaussing circuit using dual PTC thermistor.



Data of each degaussing coil

	double-coil system	single-coil system
Circumference	117 cm	237 cm
Number of turns	60	60
Copper-wire diameter	0,35 mm	0,35 mm
Resistance (R_c)	12,5 Ω	25,1 Ω
Catalogue number of appropriate dual PTC thermistor	2322 662 98009	2322 662 98009

COLOUR PICTURE TUBE

QUICK REFERENCE DATA

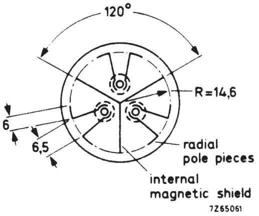
Temperature compensated shadow-mask designed for minimum moiré

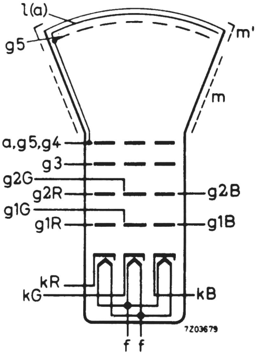
High white luminance at unity current ratio

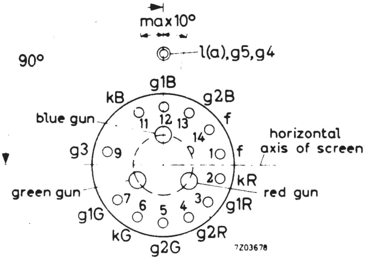
Face diagonal	56 cm
Deflection angle	110°
Neck diameter	36,5 mm
Envelope	reinforced; suitable for push-through
Magnetic shield	internal
Focusing	bi-potential
Deflection	magnetic
Convergence	magnetic
Heating	6,3 V, 730 mA
Light transmission of face glass	54,5 %
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s

MECHANICAL DATA

Overall length	387,3 to 400,3 mm
Neck diameter	36,5 mm
Diagonal	max. 566,2 mm
Horizontal axis of bulb	max. 486,3 mm
Vertical axis	max. 381,8 mm
Useful screen	
diagonal	min. 533 mm
horizontal axis	min. 447 mm
vertical axis	min. 337 mm
Base	12 pin base IEC 67-I-47a, type 2
Anode contact	Small cavity contact J1-21, IEC 67-III-2


120°
R=14,6
6
6,5
radial pole pieces
internal magnetic shield
7Z65061


l(a)
m'
g5
m
a,g5,g4
g3
g2G
g2R
g2B
g1G
g1R
g1B
kR
kG
kB
f
f
7Z03679


max 10°
l(a),g5,g4
90°
g1B
kB
g2B
blue gun
f
11
12
13
14
horizontal axis of screen
g3
9
1
10
f
2
kR
green gun
red gun
7
6
5
4
3
g1G
g1R
kG
g2R
g2G
7Z03678

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	$V_{a,g5,g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,2 to 5 kV
Grid 2 voltage for a spot cut-off at $V_{g1} = -105$ V	V_{g2}	212 to 495 V
Grid 1 voltage for spot cut-off at $V_{g2} = 300$ V	V_{g1}	−70 to −140 V

COLOUR PICTURE TUBE

Replacement type A56-510X.

20AX Hi-Bri COLOUR PICTURE TUBE

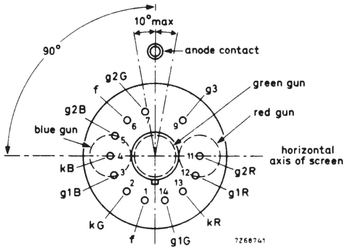
QUICK REFERENCE DATA

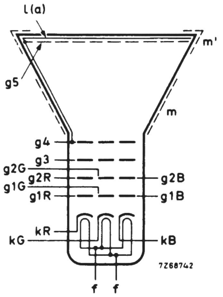
Deflection angle	110°
Face diagonal	56 cm
Overall length	37 cm
Neck diameter	36,5 mm
Envelope	reinforced; suitable for push-through
Magnetic shield	internal
Focusing	bi-potential
Deflection	magnetic
Heating	6,3 V, 720 mA
Light transmission of face glass	68%
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s

Inherently self-converging system with deflection unit AT1083/01

MECHANICAL DATA

Overall length	373,8 ± 6,5 mm
Neck diameter	$36,5\,^{+1,6}_{-0}$ mm
Bulb dimensions	
diagonal	max. 566,2 mm
width	max. 486,3 mm
height	max. 381,8 mm
Useful screen dimensions	
diagonal	min. 530,6 mm
horizontal axis	min. 444,2 mm
vertical axis	min. 334,2 mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	small cavity contact J1-21, IEC 67-III-2


90°
10°max
anode contact
g2G
f
g3
green gun
red gun
g2B
blue gun
horizontal
axis of screen
kB
g2R
g1B
g1R
kG
f
g1G
kR
1
2
3
4
5
6
7
9
11
12
13
14
7Z68741


l(a)
m'
g5
m
g4
g3
g2G
g2R
g1G
g1R
g2B
g1B
kR
kG
kB
f
f
7Z68742

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Final accelerator voltage	$V_{a,g5,g4}$	25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8	kV
Grid 2 voltage for a spot-cut-off voltage V_k = 140 V	V_{g2}	465 to 705	V
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165	V

30AX COLOUR PICTURE TUBE

- Automatic snap-in raster orientation
- Push-on axial purity positioning
- Internal magneto-static beam alignment
- Hi-Bi gun with quadrupole cathode lens
- Self-aligning, self-converging assembly with low power consumption, when combined with deflection unit AT 1260
- North-south pin-cushion distortion-free
- 110° deflection
- Hi-Bri screen
- Pigmented phosphors: enhanced contrast
- Phosphor lines follow glass contour
- In-line gun
- Standard 36,5 mm neck
- Soft-Flash technology
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Quick-heating cathodes
- Internal magnetic shield
- Anti-crackle coating
- Reinforced envelope for push-through mounting

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	56 cm
Overall length	38 cm
Neck diameter	36,5 mm
Heating	6,3 V, 720 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	in line with separate grids
Focusing method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	110°
horizontal	97°
vertical	77°

ELECTRICAL DATA

Capacitances				
anode to external conductive coating	$C_{a,\ g5,\ g4/m}$	max. min.	1800 1300	pF pF
anode to metal rimband	$C_{a,\ g5,\ g4/m'}$		250	pF
grid of any gun to all other electrodes	$C_{g\ 1R}$, $C_{g\ 1G}$, $C_{g\ 1B}$		7	pF
cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4	pF
grid 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF
Resistance between rimband and external conductive coating		min.	50	MΩ
Heating: indirect by a.c. (preferably mains or line frequency) or d.c.				
heater voltage	V_f		6,3	V*
heater current	I_f		720	mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 530,6 mm
horizontal axis	min. 444,2 mm
vertical axis	min. 334,2 mm
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type

---

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V. For heating time as a function of source impedance see graph on the last page but one of this data sheet.

Colour co-ordinates	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060

Centre-to-centre distance of identical colour phosphor stripes	approx. 0,8 mm
Light transmission of face glass	64%
Luminance at the centre of the screen	L 160 cd/m² *

MECHANICAL DATA (see also the figures on the following pages)

Overall length	383,8 ± 6 mm
Neck diameter	$36,5\ ^{+1,3}_{-0}$ mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	cavity cap JEDEC J1-21, IEC 67-III-2
Mounting position	anode contact on top
Rimband	provided with 18 slots to accommodate clips for mounting of degaussing coils
Net mass	approx. 14,5 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s² in any direction.

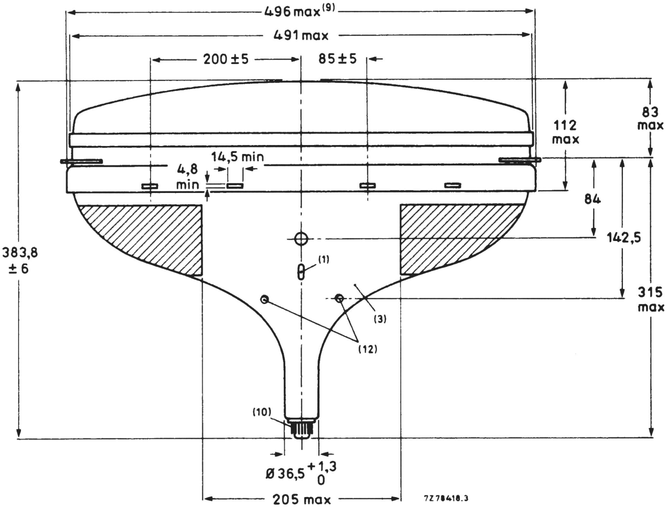
Notes to outline drawings on the following pages

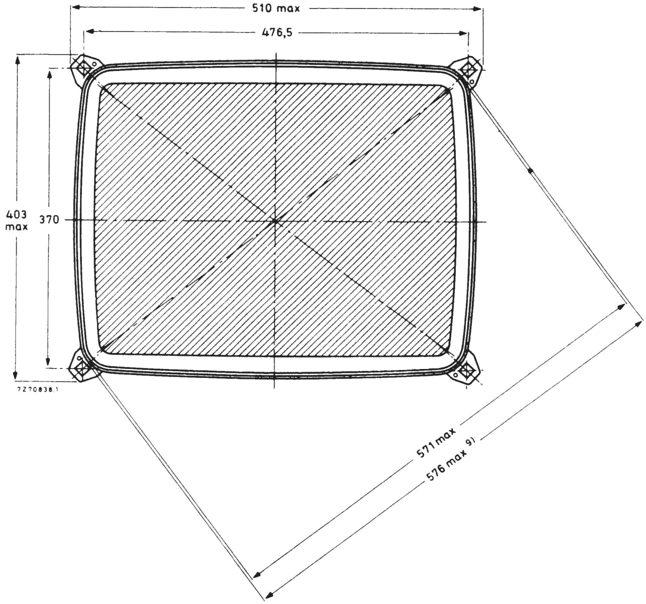
1. This ridge can be used as an orientation for the deflection unit.
2. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
3. To clean this area wipe only with a soft lintless cloth.
4. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
5. Minimum space to be reserved for mounting lug.
6. The position of the mounting screw in the cabinet must be within a circle of 9,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 476,5 mm x 370 mm.
7. Co-ordinates for radius R = 14,8 mm: x = 203,9 mm, y = 145,5 mm.
8. Distance from point z to any hardware.
9. Maximum dimensions in plane of lugs.
10. The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of the base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.
    The mass of the mating socket with circuitry should not be more than 150 g; maximum permissible torque is 40 mNm.
11. Minimum distance between glass and rimband in plane of centre line of the apertures.
12. Centring bosses for deflection unit.

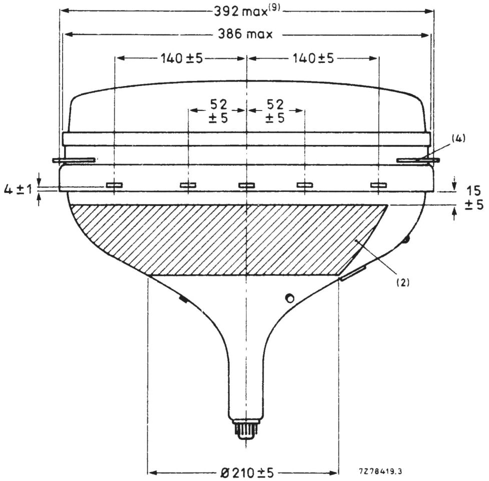
* Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm².

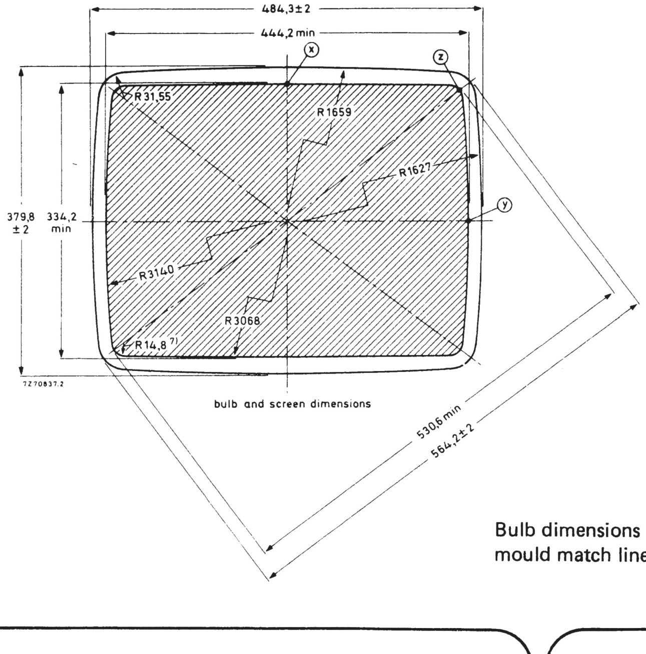
MECHANICAL DATA (continued) Dimensions in mm

Notes are on the preceding page


496 max (9)
491 max
200 ± 5
85 ± 5
112 max
83 max
14,5 min
4,8 min
84
142,5
315 max
383,8 ± 6
(1)
(3)
(12)
(10)
Ø 36,5 +1,3 0
205 max
7Z78418.3


510 max
476,5
403 max
370
571 max
576 max 9)
7Z70838.1

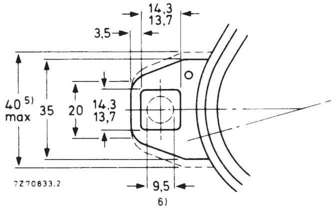

392 max(9)
386 max
140 ±5
140 ±5
52 ±5
52 ±5
(4)
4 ±1
15 ±5
(2)
Ø 210 ±5
7Z78419.3

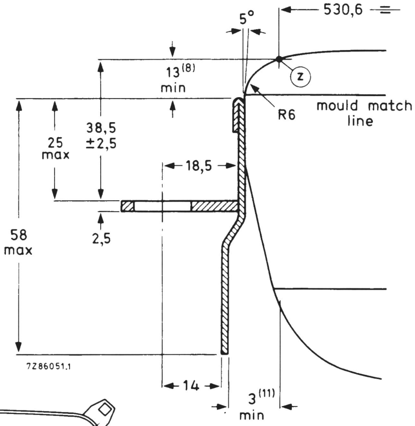

484,3±2
444,2 min
x
z
y
R 31,55
R 1659
R 1627
R 3140
R 3068
R 14,8 7)
379,8 ±2
334,2 min
530,6 min
564,2±2
7Z70837.2

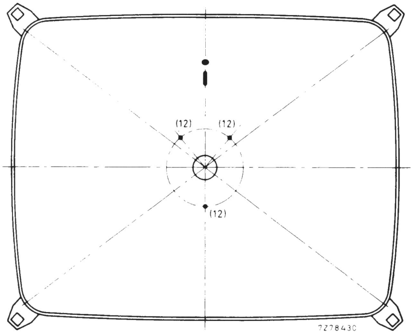
bulb and screen dimensions

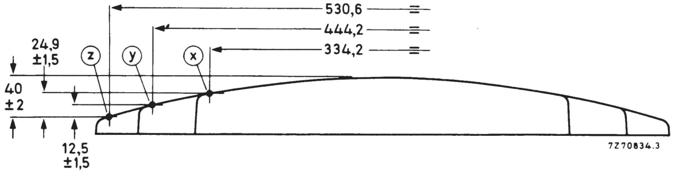
Bulb dimensions at mould match line.

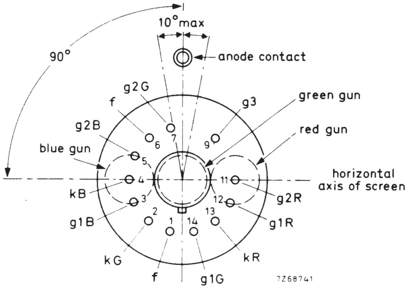
MECHANICAL DATA (continued)

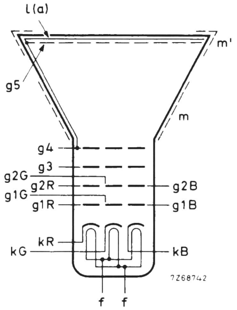

14,3
13,7
3,5
40 5)
max
35
20
14,3
13,7
9,5
6)
7Z70833.2


5°
530,6
13 (8)
min
z
R6
mould match
line
38,5
±2,5
25
max
18,5
58
max
2,5
14
3 (11)
min
7Z86051.1

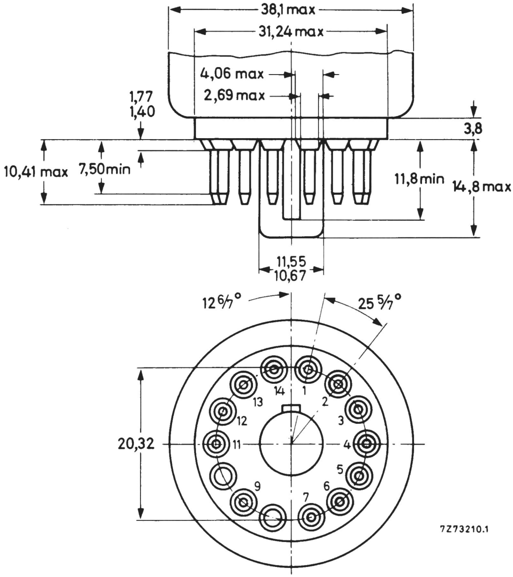

(12)
(12)
(12)
7Z78430

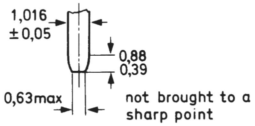

530,6
444,2
334,2
24,9
±1,5
z
y
x
40
±2
12,5
±1,5
7Z70834.3


10° max
90°
anode contact
g2G
f
g3
green gun
red gun
g2B
blue gun
horizontal
axis of screen
kB
g1B
kG
f
g1G
kR
g1R
g2R
1
2
3
4
5
6
7
9
11
12
13
14
7Z68741

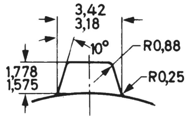

l (a)
m'
g5
m
g4
g3
g2G
g2R
g1G
g1R
g2B
g1B
kR
kG
kB
f
f
7Z68742

12-pin base, IEC 67-I-47a, type 2


38,1 max
31,24 max
4,06 max
2,69 max
1,77
1,40
3,8
10,41 max
7,50min
11,8min
14,8 max
11,55
10,67
12 6/7°
25 5/7°
20,32
1
2
3
4
5
6
7
9
11
12
13
14
7Z73210.1

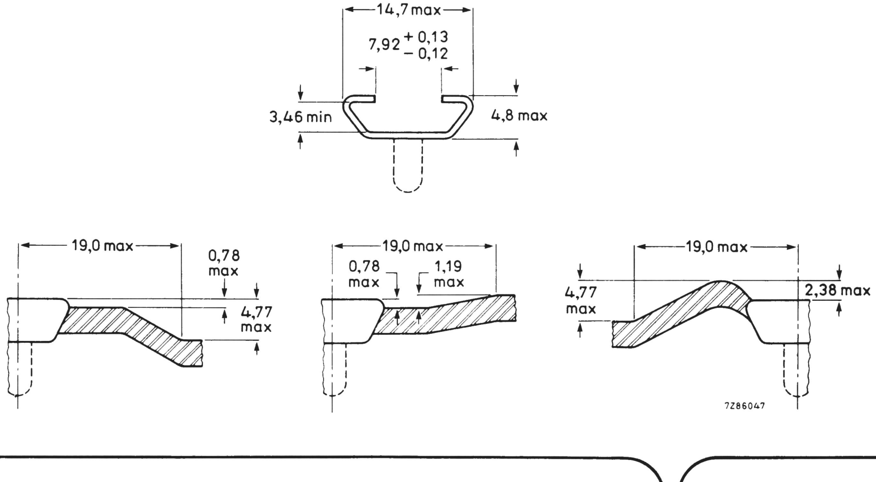

1,016
±0,05
0,88
0,39
0,63max
not brought to a
sharp point

pin contour

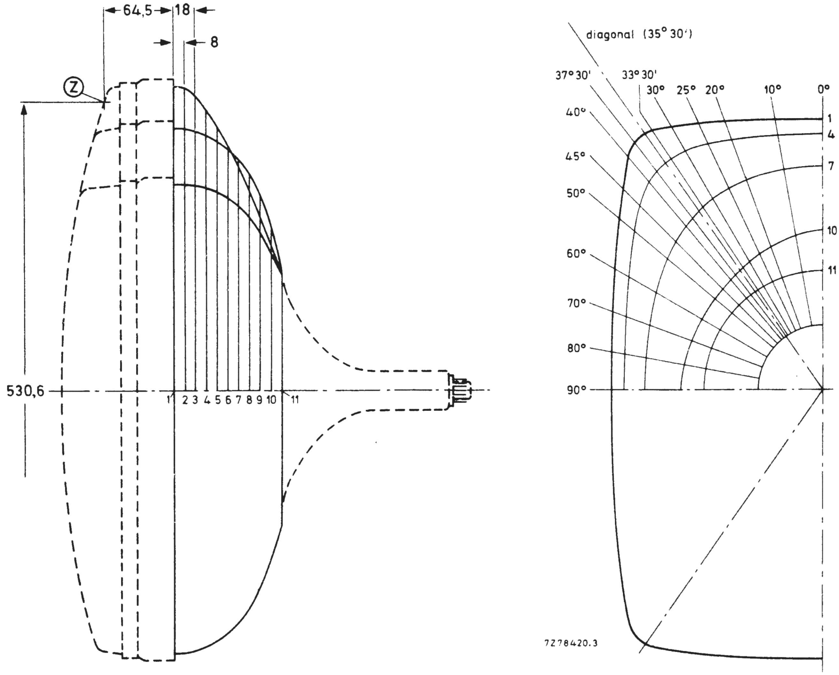

3,42
3,18
10°
R0,88
1,778
1,575
R0,25

detail of key

Cavity cap JEDEC J1-21, IEC 67-III-2


14,7 max
7,92 + 0,13 − 0,12
3,46 min
4,8 max
19,0 max
0,78 max
4,77 max
19,0 max
0,78 max
1,19 max
19,0 max
4,77 max
2,38 max
7Z86047

Maximum cone contour



sec- tion	distance from centre (max. values)														
	nom. distance from section 1	0°	10°	20°	25°	30°	33° 30′	diag.	37° 30′	40°	45°	50°	60°	70°	80°	90°
1		248,0	251,2	261,3	269,3	279,5	286,8	288,0	286,8	281,7	262,3	245,9	222,0	207,0	198,7	196,0
2	8	244,4	247,6	257,6	265,4	275,3	282,3	283,3	282,0	276,8	257,8	241,6	218,0	203,2	195,0	192,4
3	18	240,5	243,6	252,9	259,6	267,0	271,2	271,3	269,7	265,3	250,6	236,6	214,2	199,6	191,4	188,8
4	28	235,0	237,8	245,5	250,2	254,4	255,7	255,0	253,3	249,9	239,5	228,3	208,6	194,8	186,9	184,3
5	38	227,7	229,9	235,2	237,8	239,1	238,7	237,6	236,0	233,3	225,8	217,3	201,0	188,8	181,6	179,2
6	48	218,2	219,6	222,2	222,9	222,3	220,8	219,6	218,1	215,8	210,1	203,6	190,9	180,9	174,7	172,6
7	58	206,4	206,8	206,8	205,9	204,0	202,2	200,9	199,5	197,5	193,2	188,4	179,2	171,6	166,8	165,2
8	68	191,6	190,9	188,5	186,6	184,1	182,2	181,0	179,8	178,2	175,0	171,7	165,7	160,8	157,7	156,6
9	78	172,5	170,9	166,8	164,4	161,9	160,1	159,1	158,2	157,0	154,8	152,9	149,7	145,6	146,5	146,2
10	88	147,0	144,8	140,5	138,3	136,3	135,0	134,3	133,6	132,9	131,7	130,8	130,0	130,3	131,3	132,0
11	97,1	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0

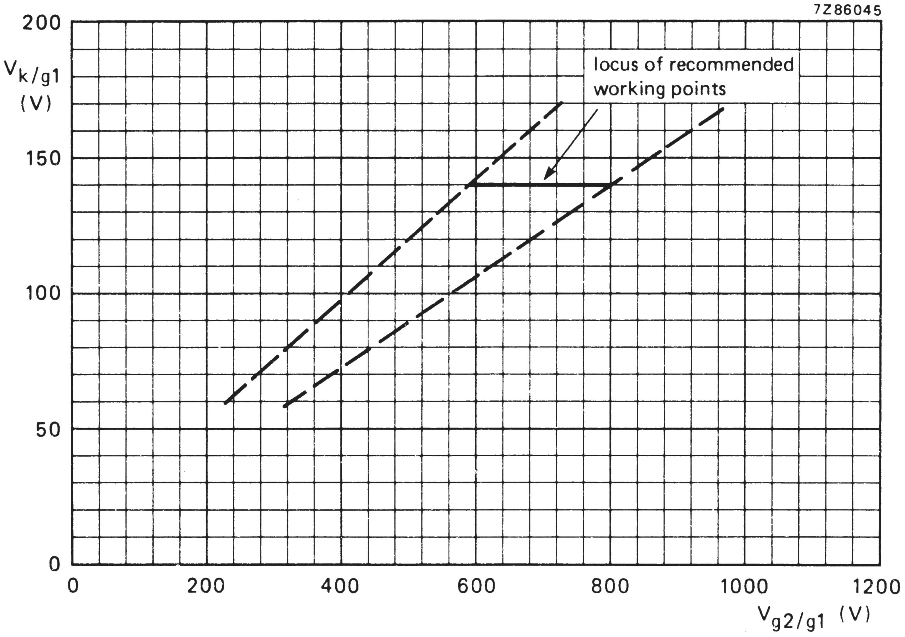
RECOMMENDED OPERATING CONDITIONS (cathode drive)

The voltages are specified with respect to grid 1.

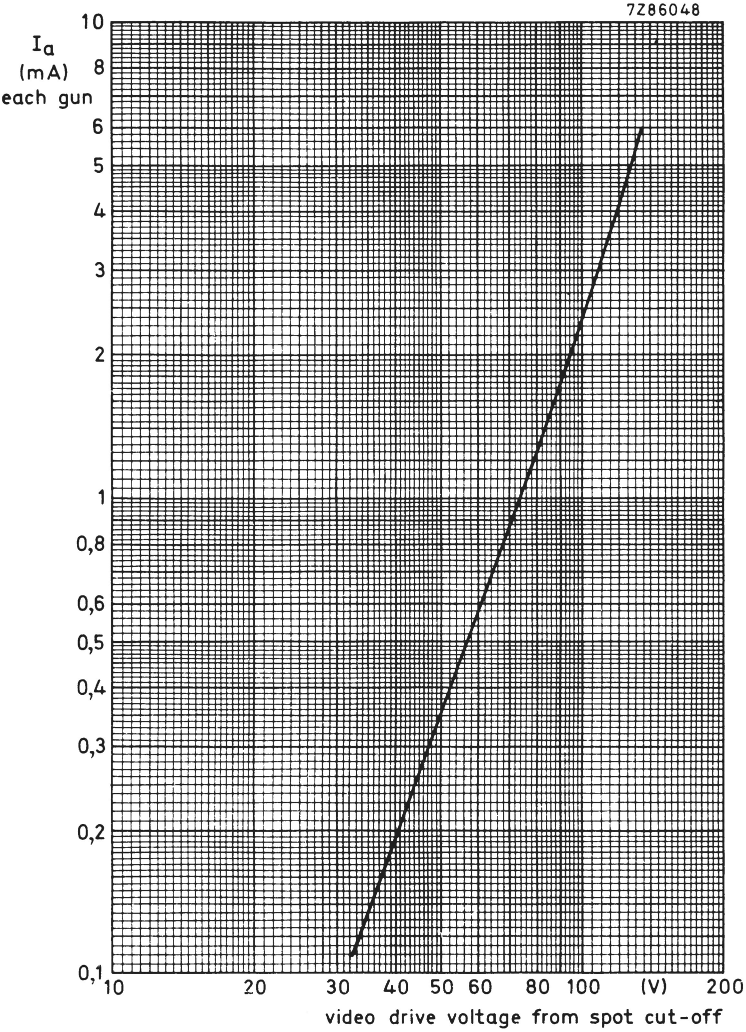
Anode voltage	$V_{a, g5, g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,5 to 7,45 kV

A. Operation at equal spot cut-off voltage V_k = 140 V

Grid 2 voltage (V_{g2}) adjusted for each gun separately; V_{g2} range 590 to 800 V.



Spot cut-off design chart.



Typical cathode drive characteristic.

V_f = 6,3 V;

$V_{a,\ g5,\ g4}$ = 25 kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for V_k = 140 V.

B. Operation at equal grid 2 voltage

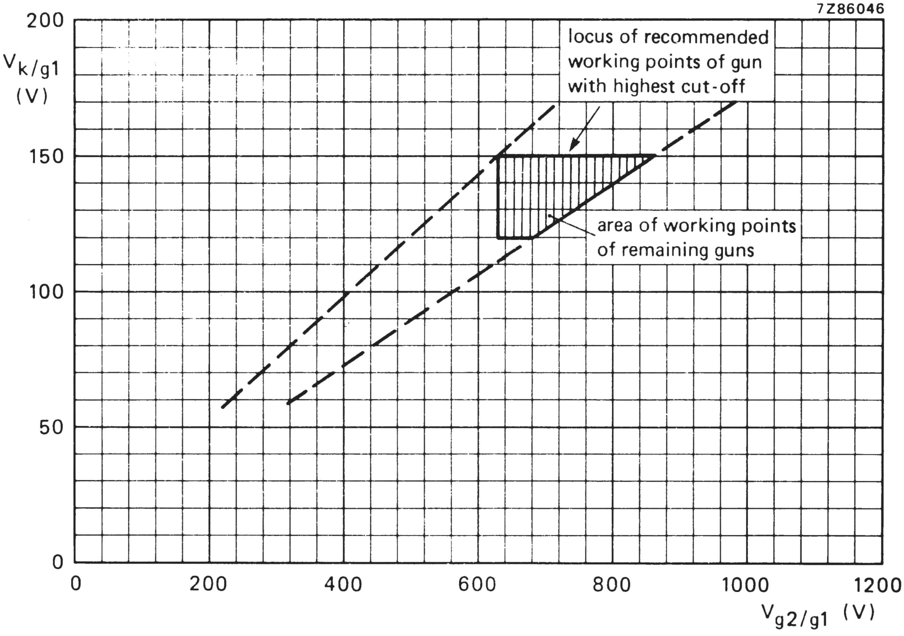
Grid 2 voltage (V_{g2}) adjusted for highest gun spot cut-off voltage V_k = 150 V.

Remaining guns adjusted for spot cut-off by means of cathode voltage.

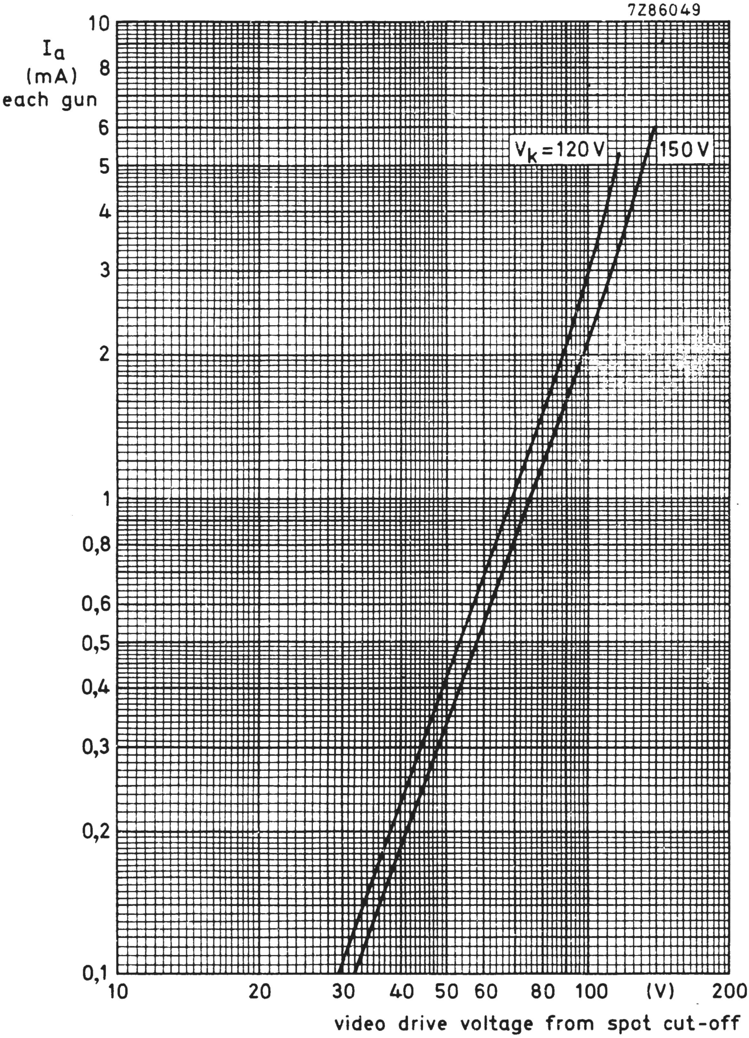
V_{g2} range 630 to 860 V.
V_k range 120 to 150 V.

Adjustment procedure:

Set the cathode voltage (V_k) for each gun at 150 V; increase the grid 2 voltage (V_{g2}) from approx. 600 V to the value at which one of the colours becomes just visible. Now decrease the cathode voltage of the remaining guns so that the other colours also become visible.



Spot cut-off design chart.



Typical cathode drive characteristic.

V_f = 6,3 V;

$V_{a,\ g5,\ g4}$ = 25 kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for V_k = 120 V and 150 V.

EQUIPMENT DESIGN VALUES (each gun if applicable)

The values are valid for anode voltages between 22,5 and 27,5 kV.

The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26 to 29,8% of final accelerator voltage
Difference in cut-off voltage between guns in one tube	ΔV_k	lowest value is min. 80% of highest value
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current at V_k = 140 V	I_{g1}	−5 to + 5 μA

To produce white D, CIE co-ordinates x = 0,313, y = 0,329.

Percentage of the total anode current supplied by each gun (typical)

red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

BEAM CENTRING

Maximum centring error in any direction 4,5 mm

LIMITING VALUES (each gun if applicable)

Design maximum rating system unless otherwise stated.

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a, g5, g4}$	max. min.	27,5 kV 22,5 kV	notes 1, 2, 3 note 4
Long-term average current for three guns	I_a	max.	1000 μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	9 kV	
Grid 2 voltage	V_{g2}	max.	1200 V	note 6
Cathode voltage				
positive	V_k	max.	400 V	
positive operating cut-off	V_k	max.	200 V	
negative	$-V_k$	max.	0 V	
negative peak	$-V_{kp}$	max.	2 V	
Cathode to heater voltage				
positive	V_{kf}	max.	250 V	
positive peak	V_{kfp}	max.	300 V	note 1
negative	$-V_{kf}$	max.	135 V	
negative peak	$-V_{kfp}$	max.	180 V	note 1

Notes

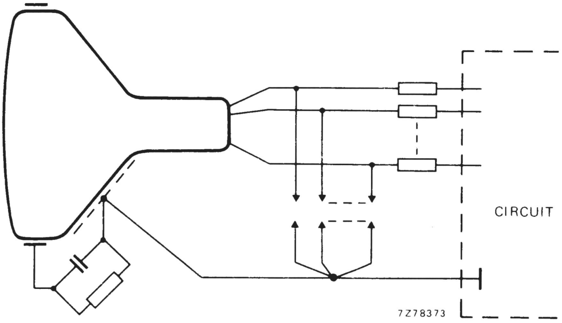
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 36 pA/kg (0,5 mR/h), measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution, and could impair convergence.
5. The short-term average anode current should be limited by circuitry to 1500 μA.
6. During adjustment on the production line max. 1500 V is permitted.

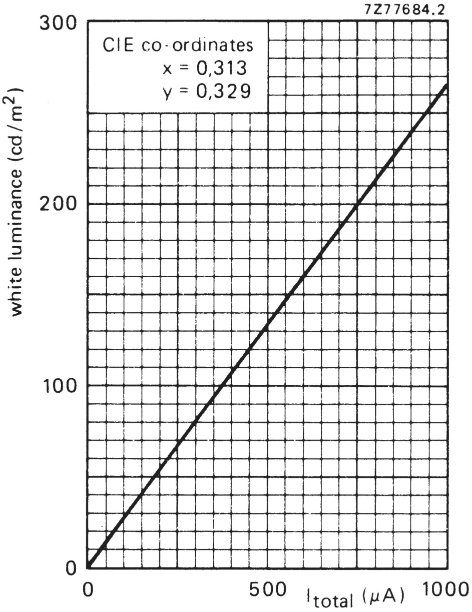
FLASHOVER PROTECTION

High electric field strengths are present between the gun electrodes of picture tubes. Voltages between gun electrodes may reach values of 20 kV over approx. 1 mm. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

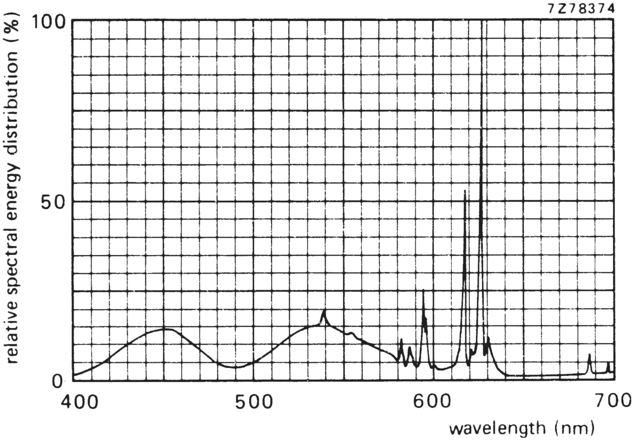
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage and damage to the circuitry which is directly connected to the tube socket. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible. The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 10,5 kV, and at the other electrodes of 1,5 to 2 kV. The values of the series isolation resistors should be as high as possible (min. 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.



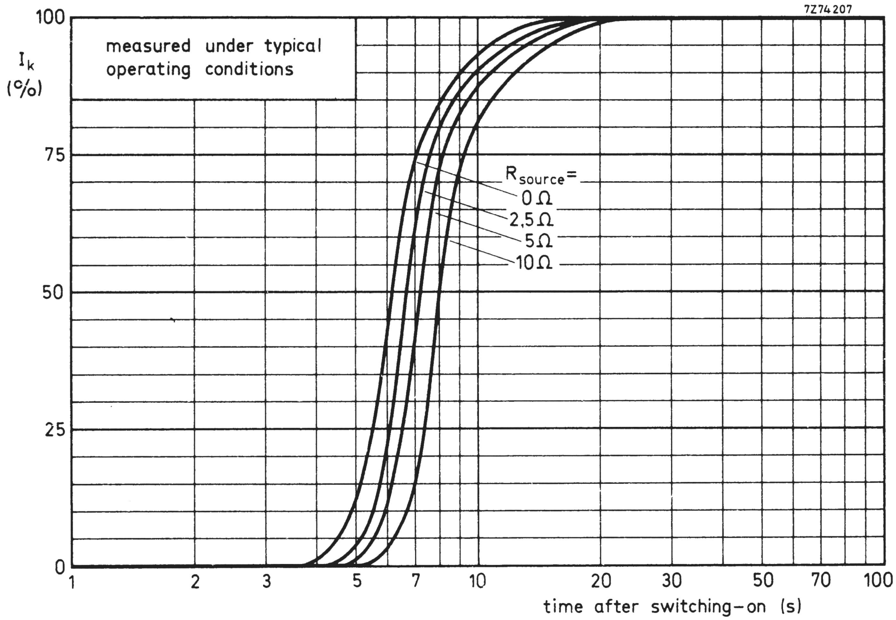


Luminance at the centre of the screen as a function of I_{total}. Scanned area 444,2 mm x 334,2 mm.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

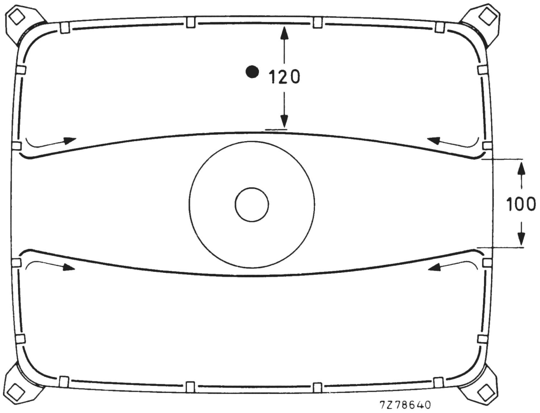
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



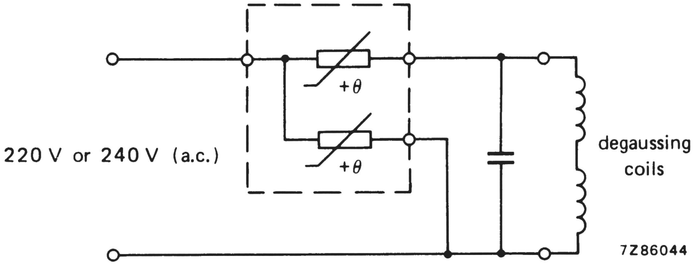
Cathode heating time to attain a certain percentage of the cathode current at equilibrium conditions.

DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts.
For proper degaussing an initial magnetomotive force (m.m.f.) of 250 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (⩽ 0,25 ampere-turns).
If single-phase power rectification is employed in the TV circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.
To ease the mounting of the coils, the rimband is provided with rectangular holes. An example is given below.



Position of degaussing coils on the picture tube.



Degaussing circuit using
dual PTC thermistor
2322 662 98009.

Data of each degaussing coil

Circumference	120 cm
Number of turns	50
Copper-wire diameter	0,35 mm
Aluminium-wire diameter	0,45 mm
Resistance	12 Ω

COLOUR PICTURE TUBE

QUICK REFERENCE DATA

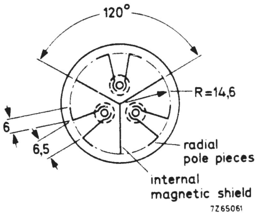
Temperature compensated shadow-mask designed for minimum moiré

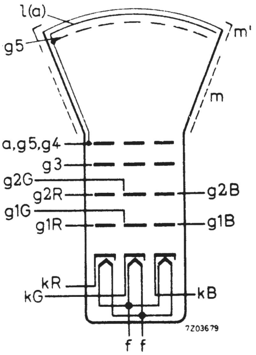
High white luminance at unity current ratio

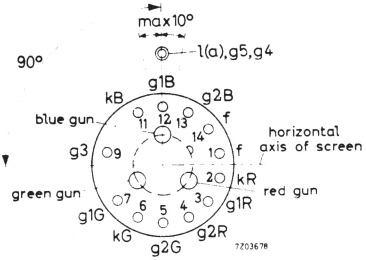
Face diagonal	66 cm
Deflection angle	110°
Neck diameter	36,5 mm
Envelope	reinforced; suitable for push-through
Magnetic shield	internal
Focusing	bi-potential
Deflection	magnetic
Convergence	magnetic
Heating	6,3 V, 730 mA
Light transmission of face glass	52,5 %
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s

MECHANICAL DATA

Overall length		425,1 to 438,1 mm
Neck diameter		36,5 mm
Diagonal	of bulb	max. 657,6 mm
Horizontal axis	of bulb	max. 556,4 mm
Vertical axis	of bulb	max. 435,3 mm
Useful screen		
diagonal		min. 617,8 mm
horizontal axis		min. 518 mm
vertical axis		min. 390 mm
Base		12 pin base JEDEC B12-246
Anode contact		Small cavity contact J1-21, IEC 67-III-2


120°
R=14,6
6
6,5
radial pole pieces
internal magnetic shield
7Z65061


l(a)
m'
g5
m
a,g5,g4
g3
g2G
g2R
g2B
g1G
g1R
g1B
kR
kG
kB
f f
7Z03679


max 10°
90°
l(a),g5,g4
g1B
kB
g2B
blue gun
12
11
13
14
f
horizontal axis of screen
g3
9
10
f
2
kR
red gun
green gun
7
6
5
4
3
g1R
g1G
kG
g2G
g2R
7Z03678

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	$V_{a,g5,g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,2 to 5 kV
Grid 2 voltage for a spot cut-off at $V_{g1} = -105$ V	V_{g2}	212 to 495 V
Grid 1 voltage for spot cut-off at $V_{g2} = 300$ V	V_{g1}	−70 to −140 V

COLOUR PICTURE TUBE

Replacement type A66-510X.

20AX Hi-Bri COLOUR PICTURE TUBE

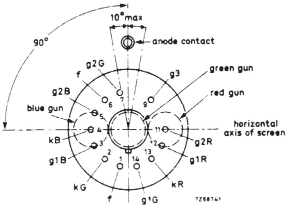
QUICK REFERENCE DATA

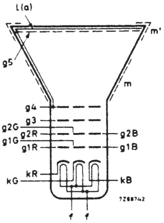
Deflection angle	110°
Face diagonal	66 cm
Overall length	41 cm
Neck diameter	36,5 mm
Envelope	reinforced; suitable for push-through
Magnetic shield	internal
Focusing	bi-potential
Deflection	magnetic
Heating	6,3 V, 720 mA
Light transmission of face glass	68%
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s

Inherently self-converging system with deflection unit AT1080

MECHANICAL DATA

Overall length	411,6 ± 6,5 mm
Neck diameter	$36{,}5\,^{+1{,}6}_{-0}$ mm
Bulb dimensions	
diagonal	max. 657,6 mm
width	max. 556,4 mm
height	max. 435,3 mm
Useful screen dimensions	
diagonal	min. 617,8 mm
horizontal axis	min. 518,0 mm
vertical axis	min. 390,0 mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	small cavity contact J1-21, IEC 67-III-2


90°
10° max
anode contact
g2G
f
g3
green gun
red gun
g2B
blue gun
horizontal axis of screen
kB
g2R
g1B
g1R
kG
f
g1G
kR
1
2
3
4
5
6
7
9
11
12
13
14
7Z68741


l(a)
m'
g5
m
g4
g3
g2G
g2R
g1G
g1R
g2B
g1B
kR
kG
kB
f
f
7Z68742

TYPICAL OPERATING CONDITIONS

The voltages are specified with respect to grid 1.

Final accelerator voltage	$V_{a,g5,g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8 kV
Grid 2 voltage for a spot-cut-off voltage V_k = 140 V	V_{g2}	465 to 705 V
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165 V

30AX COLOUR PICTURE TUBE

- Automatic snap-in raster orientation
- Push-on axial purity positioning
- Internal magneto-static beam alignment
- Hi-Bi gun with quadrupole cathode lens
- Self-aligning, self-converging assembly with low power consumption, when combined with deflection unit AT1270/00
- North-south pin-cushion distortion-free
- 110° deflection
- Hi-Bri screen
- Pigmented phosphors: enhanced contrast
- Phosphor lines follow glass contour
- In-line gun
- Standard 36,5 mm neck
- Soft-Flash technology
- Slotted shadow mask optimized for minimum moiré
- Fine pitch over entire screen
- Quick-heating cathodes
- Internal magnetic shield
- Anti-crackle coating
- Reinforced envelope for push-through mounting

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	66 cm
Overall length	42 cm
Neck diameter	36,5 mm
Heating	6,3 V, 720 mA
Focusing voltage	28% of anode voltage

ELECTRON-OPTICAL DATA

Electron gun system	in-line with separate grids
Focusing method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	110°
horizontal	97°
vertical	77°

ELECTRICAL DATA

Capacitances			
anode to external conductive coating	$C_{a,\ g5,\ g4/m}$	max.	2000 pF
		min.	1500 pF
anode to metal rimband	$C_{a,\ g5,\ g4/m'}$		300 pF
grid of any gun to all other electrodes	$C_{g\,1R}$, $C_{g\,1G}$, $C_{g\,1B}$		7 pF
cathodes of all guns (connected in parallel) to all other electrodes	C_k		12 pF
cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4 pF
grid 3 (focusing electrode) to all other electrodes	C_{g3}		7 pF
Resistance between rimband and external conductive coating		min.	50 MΩ

Heating: indirect by a.c. (preferably mains or line frequency) or d.c.

heater voltage	V_f	6,3 V *
heater current	I_f	720 mA

OPTICAL DATA

Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	satinized
Useful screen dimensions	
diagonal	min. 617,8 mm
horizontal axis	min. 518 mm
vertical axis	min. 390 mm
Phosphors	
red	pigmented europium activated rare earth
green	sulphide type
blue	pigmented sulphide type

---

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V. For heating time as a function of source impedance see graph on the last page but one of this data sheet.

Colour co-ordinates	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060

Centre-to-centre distance of identical colour phosphor stripes	approx. 0,8 mm
Light transmission of face glass	68%
Luminance at the centre of the screen	L 170 cd/m² *

MECHANICAL DATA (see also the figures on the following pages)

Overall length	421,6 ± 6 mm
Neck diameter	$36{,}5^{+1{,}3}_{-0}$ mm
Base	12-pin base IEC 67-I-47a, type 2
Anode contact	cavity cap JEDEC J1-21, IEC 67-III-2
Mounting position	anode contact on top
Rimband	provided with 18 slots to accommodate clips for mounting of degaussing coils
Net mass	approx. 20 kg

Handling

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s² in any direction.

Notes to outline drawings on the following pages

1. This ridge can be used as an orientation for the deflection unit.
2. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
3. To clean this area, wipe only with a soft lintless cloth.
4. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
5. Minimum space to be reserved for mounting lug.
6. The position of the mounting screw in the cabinet must be within a circle of 9,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 549 mm x 422 mm.
7. Co-ordinates for radius R = 18,2 mm: x = 236,6 mm, y = 168,9 mm.
8. Distance from point z to any hardware.
9. Maximum dimensions in plane of lugs.
10. The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of the base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.
    The mass of the mating socket with circuitry should not be more than 150 g; maximum permissible torque is 40 mNm.
11. Minimum distance between glass and rimband in plane of the apertures.
12. Centring bosses for deflection unit.

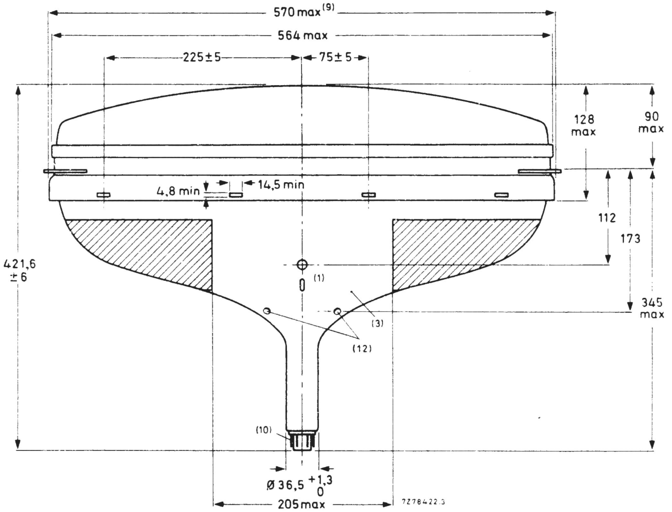
---

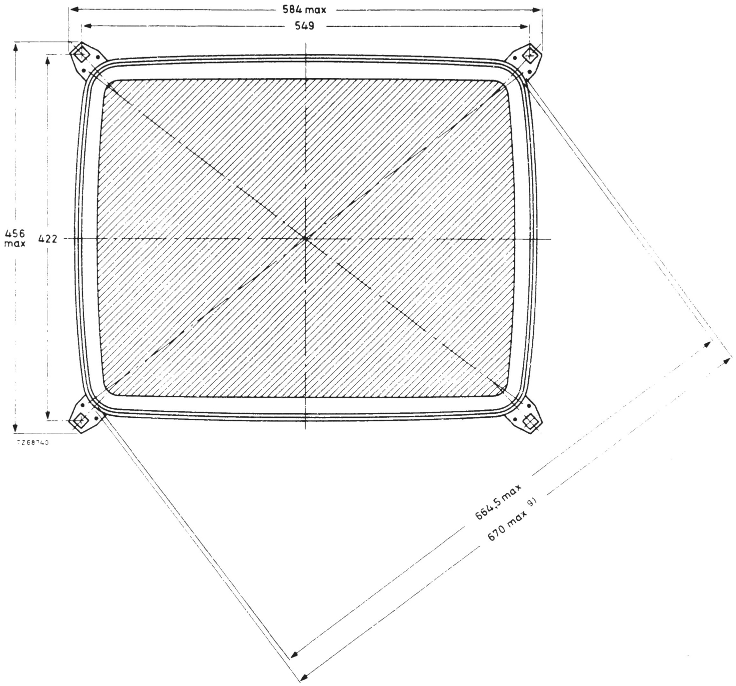
* Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm².

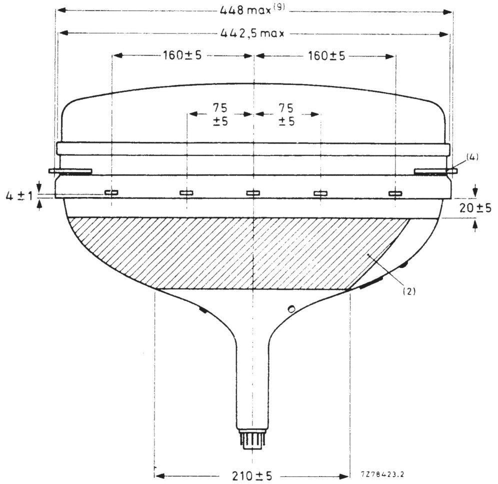
MECHANICAL DATA (continued)

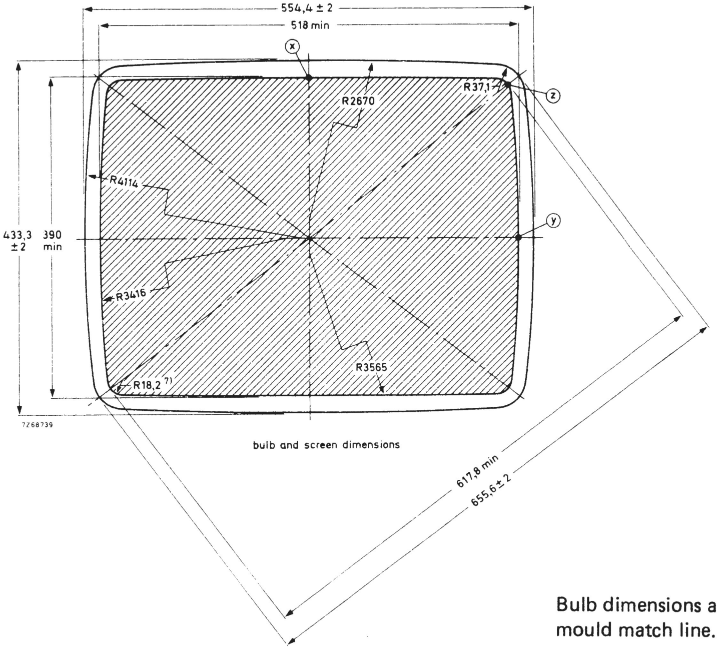
Dimensions in mm

Notes are on the preceding page


570 max (9)
564 max
225±5
75±5
128 max
90 max
4,8 min
14,5 min
112
173
421,6 ±6
(1)
(3)
(12)
345 max
(10)
Ø 36,5 +1,3 0
205 max
7Z78422.3


584 max
549
456 max
422
664,5 max
670 max (9)
7Z68740

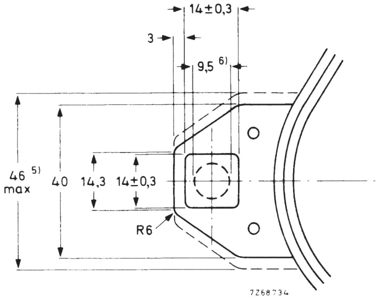

448 max (9)
442,5 max
160±5
160±5
75 ±5
75 ±5
(4)
4 ±1
20±5
(2)
210±5
7Z78423.2

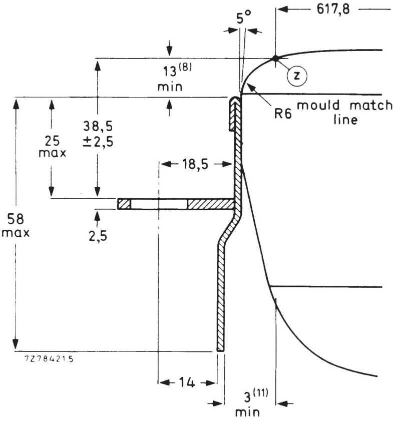

554,4 ± 2
518 min
x
R37,1
z
R2670
R4114
433,3 ±2
390 min
y
R3416
R3565
R18,2 7)
7Z68739
617,8 min
655,6±2

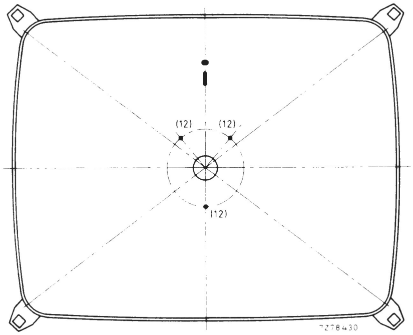
bulb and screen dimensions

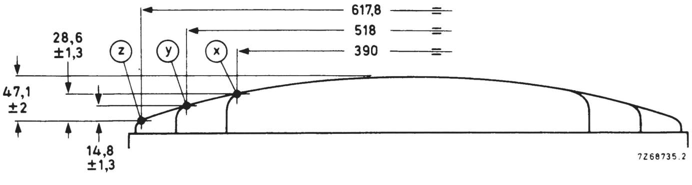
Bulb dimensions at mould match line.

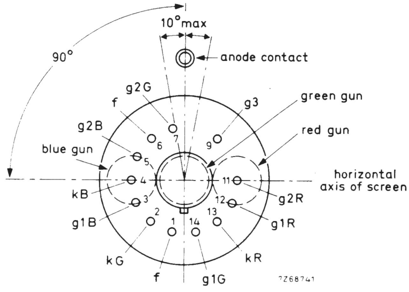
MECHANICAL DATA (continued)

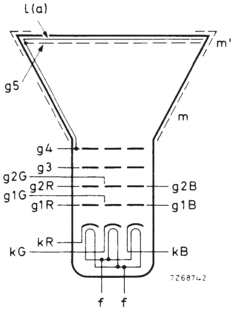

14±0,3
3
9,5 6)
46 5) max
40
14,3
14±0,3
R6
7Z68734


5°
617,8
13 (8) min
z
R6
mould match line
38,5 ±2,5
25 max
18,5
58 max
2,5
7Z78421.5
14
3 (11) min

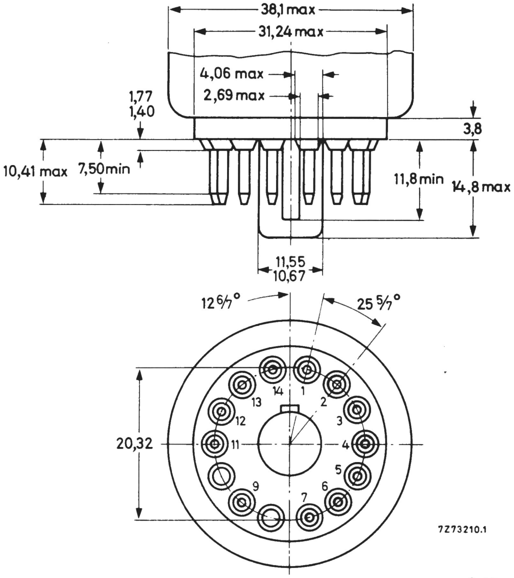

(12)
(12)
(12)
7Z78430

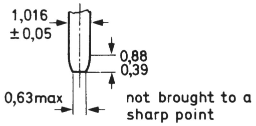

617,8
518
390
28,6 ±1,3
z
y
x
47,1 ±2
14,8 ±1,3
7Z68735.2


10° max
anode contact
90°
g2G
f
g3
green gun
g2B
red gun
blue gun
horizontal axis of screen
kB
g2R
g1B
g1R
kG
kR
f
g1G
1
2
3
4
5
6
7
9
11
12
13
14
7Z68741

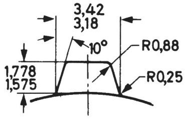

l(a)
m'
g5
m
g4
g3
g2G
g2R
g2B
g1G
g1R
g1B
kR
kG
kB
f
f
7Z68742

12-pin base, IEC 67-I-47a, type 2


38,1 max
31,24 max
4,06 max
2,69 max
1,77
1,40
3,8
10,41 max
7,50min
11,8min
14,8 max
11,55
10,67
12 6/7°
25 5/7°
20,32
1
2
3
4
5
6
7
9
11
12
13
14
7Z73210.1

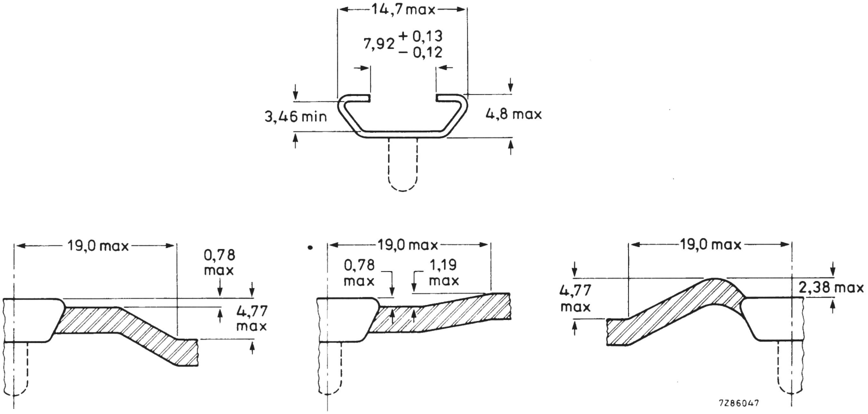

1,016
±0,05
0,88
0,39
0,63max
not brought to a
sharp point

pin contour

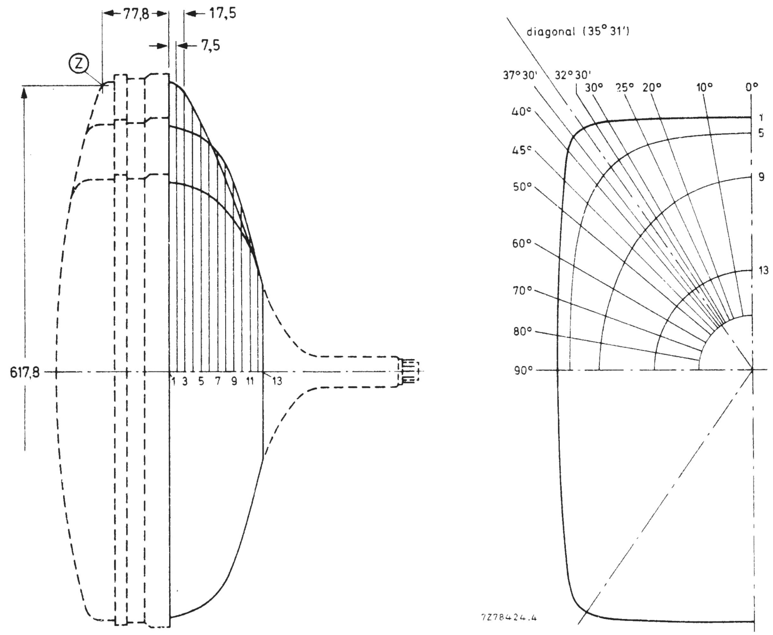

3,42
3,18
10°
R0,88
R0,25
1,778
1,575

detail of key

Cavity cap JEDEC J1-21, IEC 67-III-2


14,7 max
7,92 + 0,13 − 0,12
3,46 min
4,8 max
19,0 max
0,78
max
4,77
max
19,0 max
0,78
max
1,19
max
19,0 max
4,77
max
2,38 max
7Z86047

Maximum cone contour



section	distance from centre (max. values)														
	nominal distance from section 1	0°	10°	20°	25°	30°	32° 30′	diag.	37° 30′	40°	45°	50°	60°	70°	80°	90°
1	0	279,0	283,0	295,4	305,2	318,0	325,4	329,0	327,5	320,7	296,5	276,7	248,3	230,7	221,1	218,0
2	7,5	276,4	280,3	292,5	302,0	313,8	320,4	323,1	321,3	314,8	292,5	273,5	245,6	228,1	218,5	215,5
3	17,5	273,4	277,1	288,2	296,2	304,8	308,7	309,2	307,0	301,9	285,1	268,8	242,5	225,3	215,8	212,8
4	27,5	268,8	272,1	281,5	287,4	292,7	294,3	293,4	291,3	287,1	274,6	261,1	237,5	221,3	212,1	209,1
5	37,5	262,3	265,1	272,0	275,7	277,9	278,0	276,4	274,4	270,9	261,4	250,5	230,4	215,7	207,2	204,3
6	47,5	254,0	255,9	260,0	261,4	261,2	260,2	258,1	256,2	253,2	245,8	237,4	221,1	208,5	201,0	198,4
7	57,5	243,5	244,5	245,3	244,6	242,7	241,2	238,8	237,0	234,4	228,5	222,1	209,6	199,7	193,4	191,3
8	67,5	230,1	229,8	227,8	225,7	222,8	221,0	218,6	217,0	214,8	210,1	205,3	196,2	188,9	184,3	184,6
9	77,5	213,3	211,9	207,8	204,9	201,7	199,9	197,7	196,3	194,5	190,9	187,4	181,2	176,4	173,4	172,4
10	87,5	194,0	191,4	185,6	182,3	178,9	177,3	175,4	174,2	172,8	170,1	167,8	164,3	162,1	161,1	161,0
11	97,5	172,8	168,1	161,4	158,0	154,9	153,5	152,0	151,1	150,0	148,2	146,9	145,7	146,0	147,3	148,2
12	107,5	142,1	139,1	133,9	131,5	129,4	128,4	127,5	126,9	126,3	125,4	124,9	125,2	126,9	129,5	131,1
13	117,5	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0

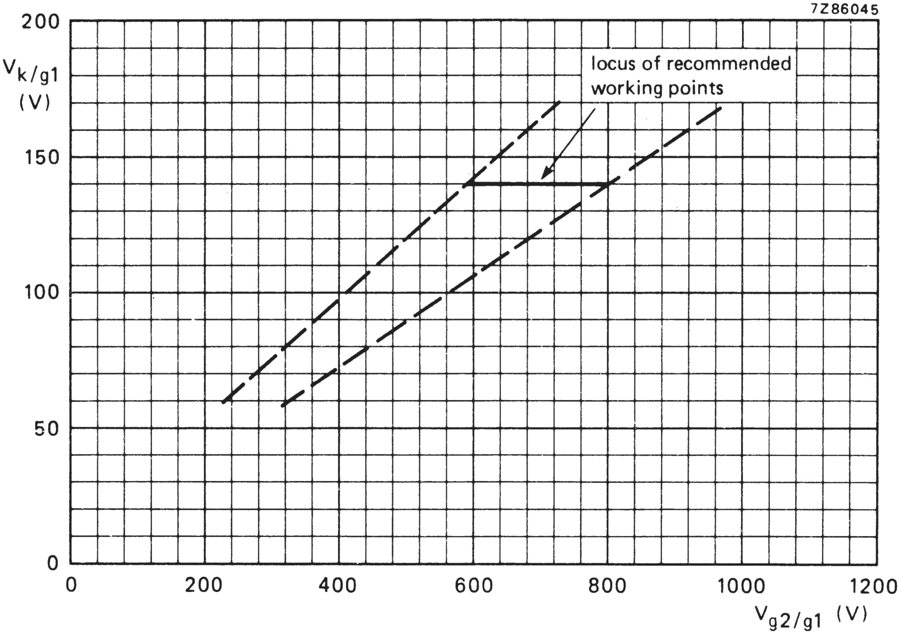
RECOMMENDED OPERATING CONDITIONS (cathode drive)

The voltages are specified with respect to grid 1.

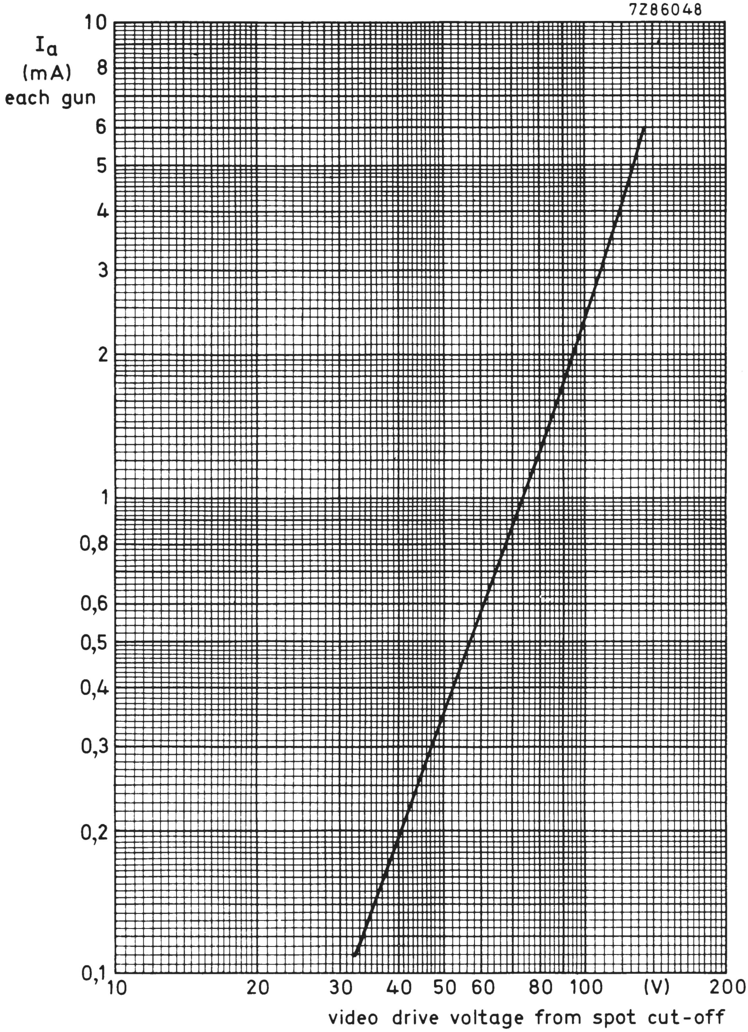
Anode voltage	$V_{a, g5, g4}$	25 kV
Grid 3 (focusing electrode) voltage	V_{g3}	6,5 to 7,45 kV

A. Operation at equal spot cut-off voltage V_k = 140 V

Grid 2 voltage (V_{g2}) adjusted for each gun separately; V_{g2} range 590 to 800 V.



Spot cut-off design chart.



Typical cathode drive characteristic.

$V_f = 6{,}3$ V;

$V_{a,\ g5,\ g4} = 25$ kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for $V_k = 140$ V.

B. Operation at equal grid 2 voltage

Grid 2 voltage (V_{g2}) adjusted for highest gun spot cut-off voltage V_k = 150 V.

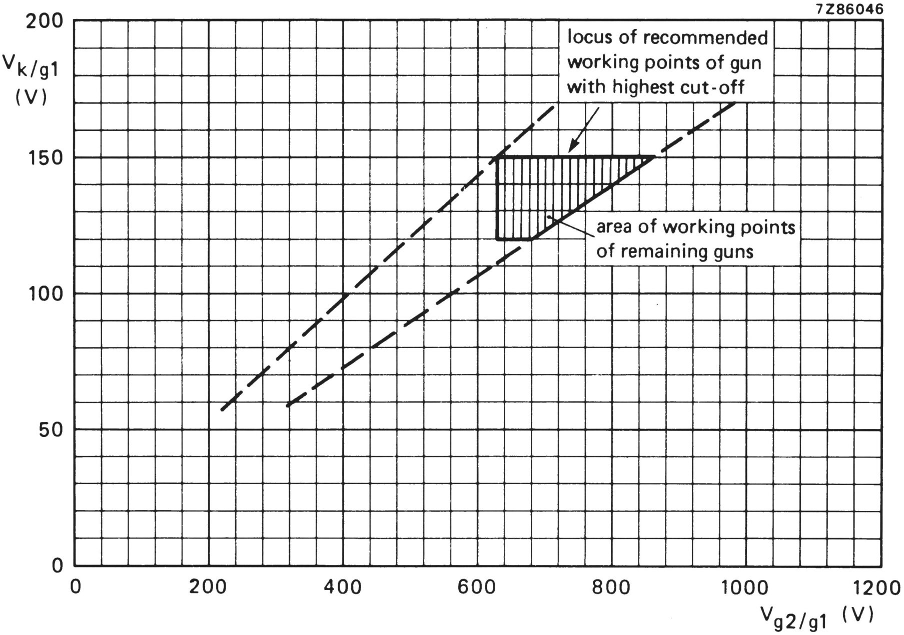
Remaining guns adjusted for spot cut-off by means of cathode voltage.

V_{g2} range 630 to 860 V.

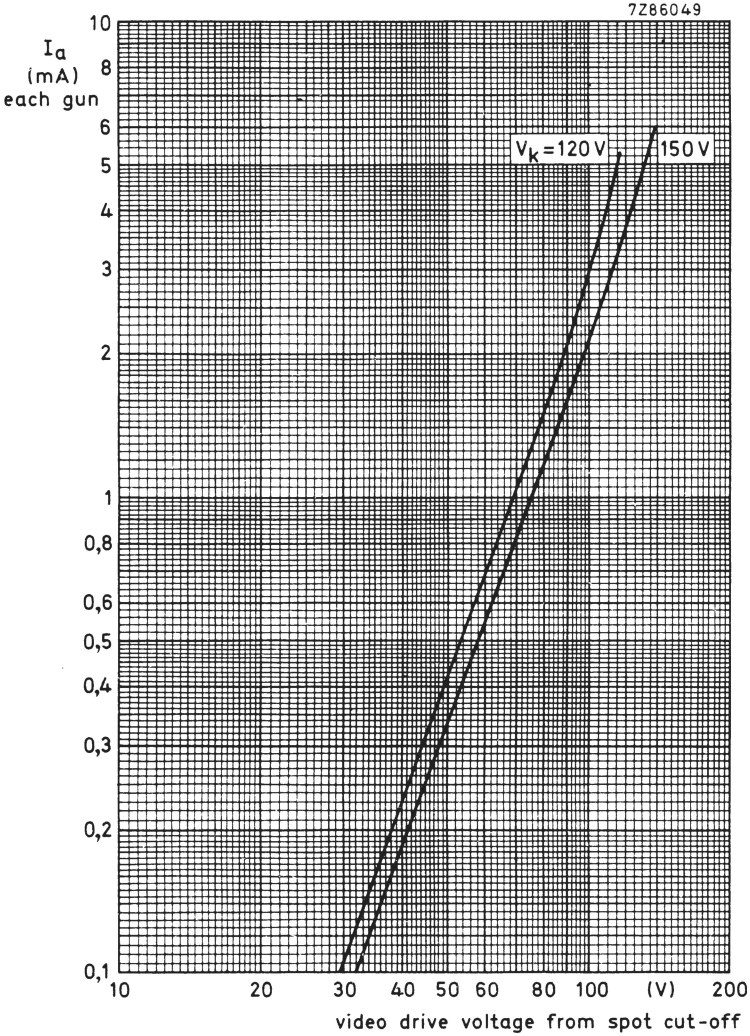
V_k range 120 to 150 V.

Adjustment procedure:

Set the cathode voltage (V_k) for each gun at 150 V; increase the grid 2 voltage (V_{g2}) from approx. 600 V to the value at which one of the colours becomes just visible. Now decrease the cathode voltage of the remaining guns so that the other colours also become visible.



Spot cut-off design chart.



Typical cathode drive characteristic.

V_f = 6,3 V;

$V_{a,\ g5,\ g4}$ = 25 kV;

V_{g3} adjusted for focus;

V_{g2} (each gun) adjusted to provide spot cut-off for V_k = 120 V and 150 V.

EQUIPMENT DESIGN VALUES (each gun if applicable)

The values are valid for anode voltages between 22,5 and 27,5 kV.

The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	26 to 29,8% of final accelerator voltage
Difference in cut-off voltage between guns in one tube	ΔV_k	lowest value is min. 80% of highest value
Grid 3 (focusing electrode) current	I_{g3}	−5 to + 5 μA
Grid 2 current	I_{g2}	−5 to + 5 μA
Grid 1 current at V_k = 140 V	I_{g1}	−5 to + 5 μA

To produce white D, CIE co-ordinates x = 0,313, y = 0,329.

Percentage of the total anode current supplied by each gun (typical)

red gun	38,3%
green gun	35,8%
blue gun	25,9%

Ratio of anode current	min.	av.	max.
red gun to green gun	0,7	1,1	1,4
red gun to blue gun	1,1	1,5	2,0
blue gun to green gun	0,5	0,7	1,0

BEAM CENTRING

Maximum centring error in any direction 5 mm

LIMITING VALUES (each gun if applicable)

Design maximum rating system unless otherwise stated.

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a, g5, g4}$	max.	27,5	kV	notes 1, 2, 3
		min.	22,5	kV	note 4
Long-term average current for three guns	I_a	max.	1000	μA	note 5
Grid 3 (focusing electrode) voltage	V_{g3}	max.	9	kV	
Grid 2 voltage	V_{g2}	max.	1200	V	note 6
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Cathode to heater voltage					
positive	V_{kf}	max.	250	V	
positive peak	V_{kfp}	max.	300	V	note 1
negative	$-V_{kf}$	max.	135	V	
negative peak	$-V_{kfp}$	max.	180	V	note 1

Notes

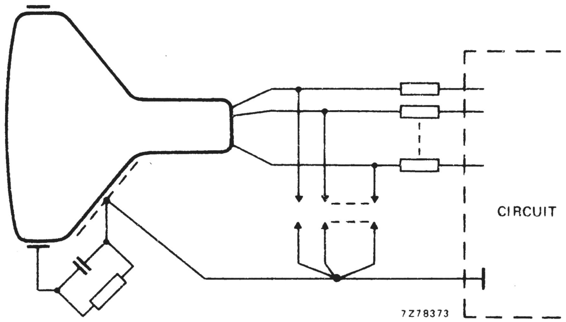
1. Absolute maximum rating system.
2. The X-ray dose rate remains below the acceptable value of 36 pA/kg (0,5 mR/h), measured with ionization chamber when the tube is used within its limiting values.
3. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.
4. Operation of the tube at lower voltages impairs the luminance and resolution, and could impair convergence.
5. The short-term average anode current should be limited by circuitry to 1500 μA.
6. During adjustment on the production line max. 1500 V is permitted.

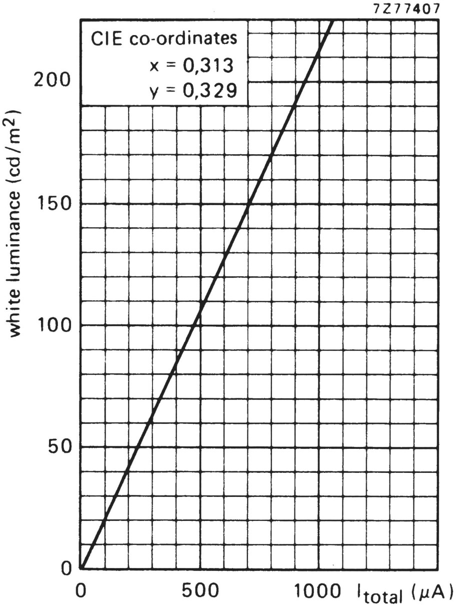
FLASHOVER PROTECTION

High electric field strengths are present between the gun electrodes of picture tubes. Voltages between gun electrodes may reach values of 20 kV over approx. 1 mm. As a result of the Soft-Flash technology these flashover currents are limited to approx. 60 A offering higher set reliability, optimum circuit protection and component savings.

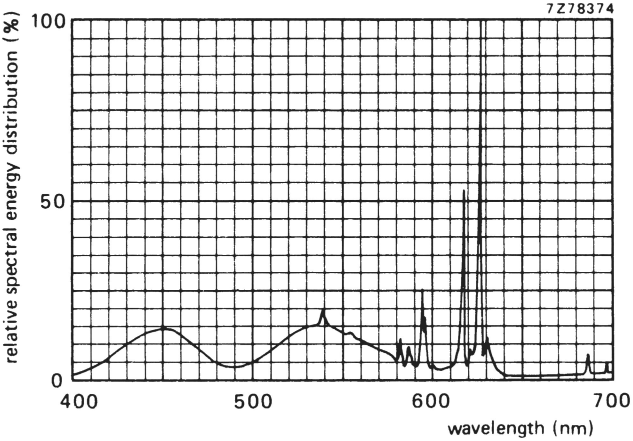
Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage and damage to the circuitry which is directly connected to the tube socket. The spark gaps should be connected to all picture tube electrodes at the socket according to the figure below; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible. The spark gaps should be designed for a breakdown voltage at the focusing electrode (g3) of 10,5 kV, and at the other electrodes of 1,5 to 2 kV. The values of the series isolation resistors should be as high as possible (min 1,5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.



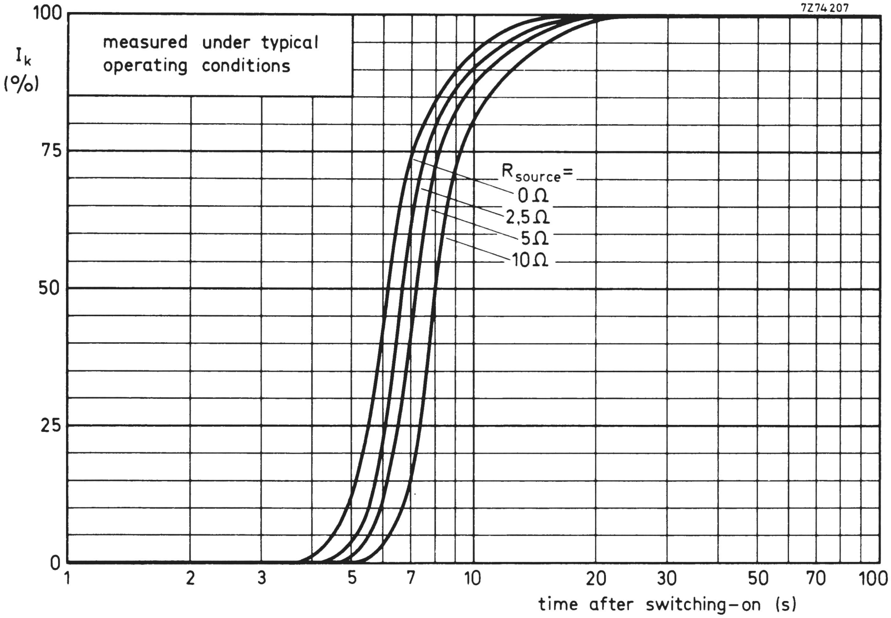


Luminance at the centre of the screen as a function of I_{total}. Scanned area 518 mm x 390 mm.



Simultaneous excitation of red, green and blue phosphor, measured in a tube, to produce white of x = 0,313, y = 0,329. Exact shape of the peaks depends on the resolution of the measuring apparatus.

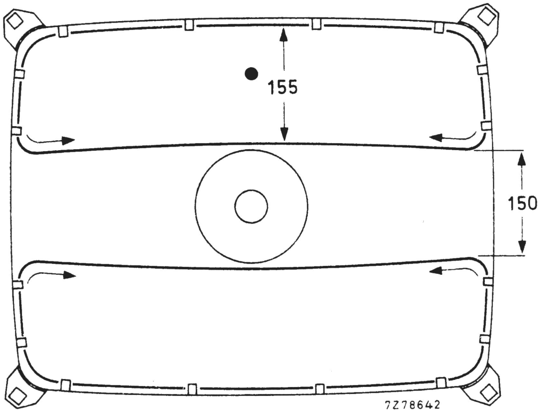
Colour co-ordinates:	x	y
red	0,635	0,340
green	0,315	0,600
blue	0,150	0,060



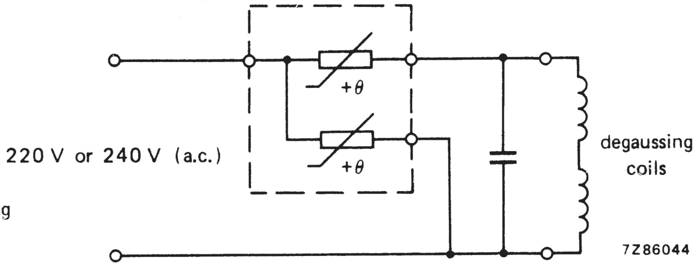
Cathode heating time to attain a certain percentage of the cathode current at equilibrium conditions.

DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts.
For proper degaussing an intial magnetomotive force (m.m.f.) of 300 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (⩽ 0,3 ampere-turns).
If single-phase power rectification is employed in the TV circuitry, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.
To ease the mounting of the coils, the rimband is provided with rectangular holes. An example is given below.



Position of degaussing coils on the picture tube.



Degaussing circuit using
dual PTC thermistor
2322 662 98009.

Data of each degaussing coil

Circumference	135 cm
Number of turns	60
Copper-wire diameter	0,4 mm
Aluminium-wire diameter	0,5 mm
Resistance	12 Ω

BLACK AND WHITE TV PICTURE TUBES

C

SURVEY

face diagonal	type	deflection angle	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g4} V	V_{g2} V	remarks
24 cm (9 in)	A24-512W	90°	20	227	11/140	10	0-130	130	quick-heating cathode
31 cm (12 in)	A31-322W	90°	20	280	11/140	12	0-130	130	quick-heating cathode
	A31-410W	110°	20	233	11/140	12-15	0-350	250	quick-heating cathode
	A31-510W	110°	20	233	11/140	12-15	0-130	130	quick-heating cathode
34 cm (14 in)	A34-111W	90°	20	287	11/140	12-15	0-130	130	quick-heating cathode
	A34-510W	110°	20	247	11/140	12-15	0-130	130	quick-heating cathode
44 cm (17 in)	A44-120W	110°	28,6	291	6,3/300	20	0-400	400	
	A44-510W	110°	20	288	11/140	12-15	0-130	130	quick-heating cathode
	A44-520W	110°	28,6	291	6,3/240	20	0-130	130	quick-heating cathode
50 cm (20 in)	A50-120W	110°	28,6	319	6,3/300	20	0-400	400	
	A50-520W	110°	28,6	319	6,3/240	20	0-130	130	quick-heating cathode
61 cm (24 in)	A61-120W	110°	28,6	370	6,3/300	20	0-400	400	
	A61-520W	110°	28,6	370	6,3/240	20	0-130	130	quick-heating cathode

TV PICTURE TUBE

24 cm (9 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode-heating time.

QUICK REFERENCE DATA

Face diagonal	24 cm (9 in)
Deflection angle	90°
Overall length	max. 227 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Anode voltage	10 kV
Quick-heating cathode	with a typical tube a legible picture will appear within 5 s.

SCREEN

Metal-backed phosphor	P4
Luminescence	white
Light transmission of face glass	53%
Useful diagonal	min. 228,6 mm
Useful width	min. 198,4 mm
Useful height	min. 149,2 mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V
Heater current	I_f	140 mA
Limits (Absolute maximum rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. 12,7 V* min. 9,3 V

For heating time as a function of source impedance see last page of this data sheet.

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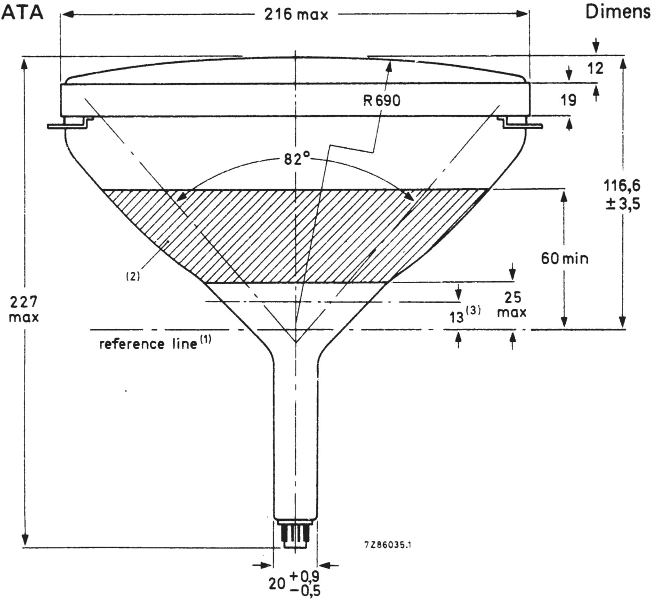
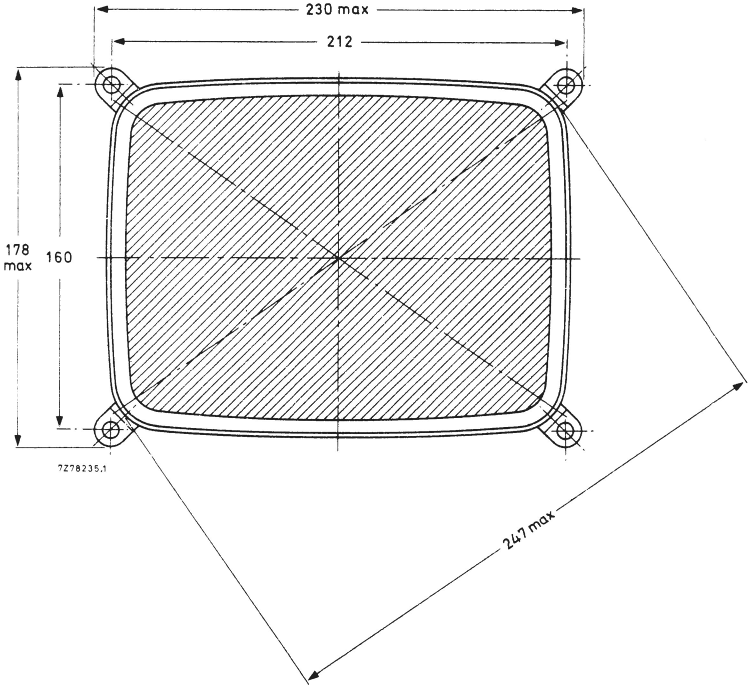
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed. For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

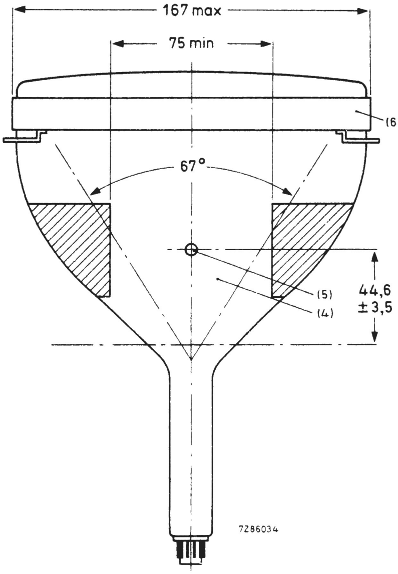
MECHANICAL DATA

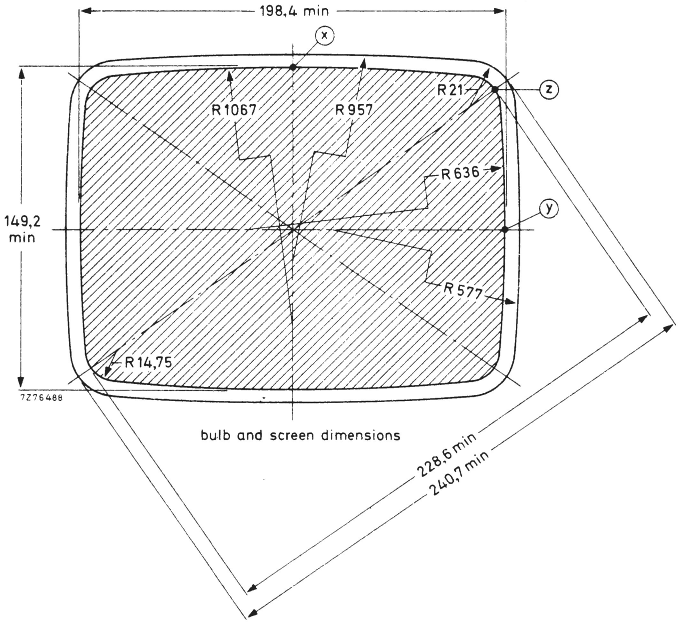
Dimensions in mm

Notes are given after the drawings

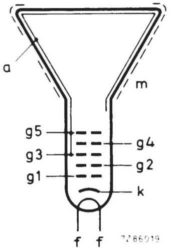

216 max
12
19
R 690
82°
116,6
± 3,5
60 min
(2)
25
max
13(3)
227
max
reference line(1)
7Z86035.1
20 +0,9 −0,5

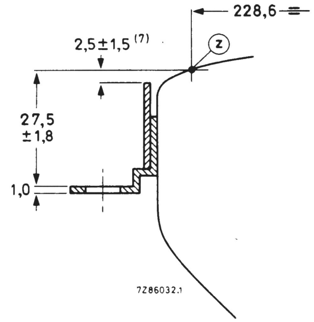

230 max
212
178
max
160
7Z78235.1
247 max

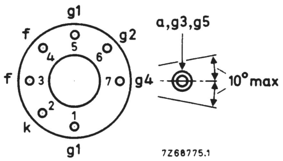

167 max
75 min
(6)
67°
(5)
(4)
44,6
±3,5
7Z86034

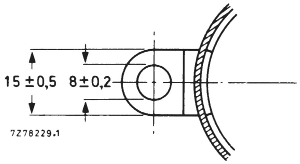

198,4 min
x
z
R 21
R 1067
R 957
R 636
y
149,2
min
R 577
R 14,75
7Z76488
228,6 min
240,7 min

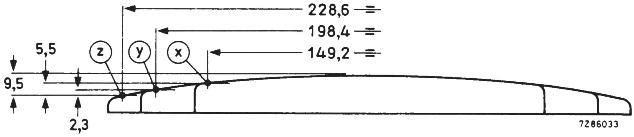
bulb and screen dimensions


a
m
g5
g3
g1
g4
g2
k
f
f
7Z86019


228,6
2,5±1,5 (7)
z
27,5
±1,8
1,0
7Z86032.1


g1
f
g2
f
4
5
6
3
7
g4
2
1
k
g1
a,g3,g5
10° max
7Z68775.1


15 ±0,5
8±0,2
7Z78229.1


228,6
198,4
149,2
5,5
z
y
x
9,5
2,3
7Z86033

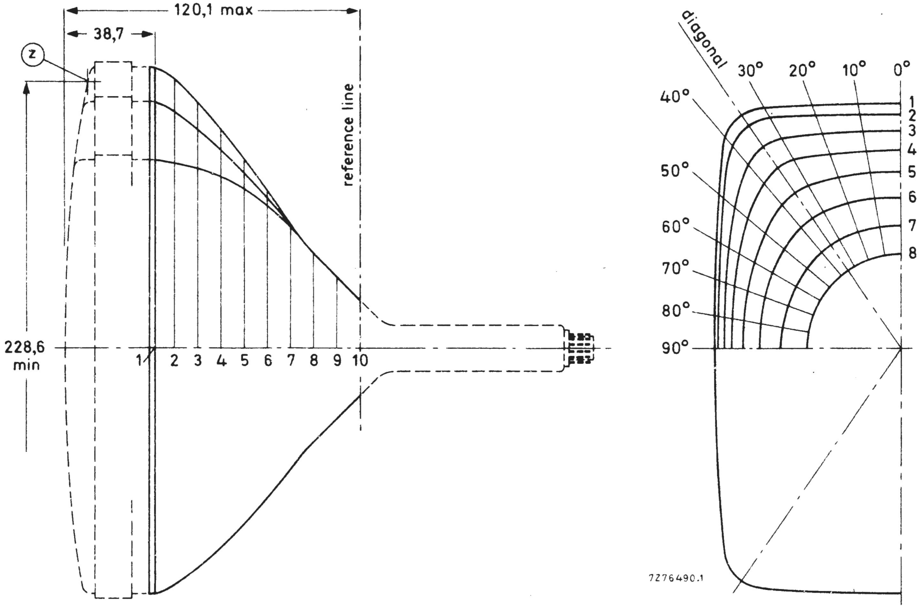
Mounting position	any
Net mass	approx. 1,8 kg
Bulb contact designation	EIA J76 1/4-B1 (EIA J240A1)
Base designation	JEDEC E7-91
Basing	7GR

The socket for this base should not be mounted rigidly; it should have flexible leads and be allowed to move freely.

Notes to outline drawings on the preceding pages

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge D.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2; JEDEC J1-21.
6. The rimband must be earthed.
7. Distance from reference point Z to any hardware.

Maximum cone contour


120,1 max
38,7
z
228,6
min
reference line
1
2
3
4
5
6
7
8
9
10
diagonal
0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
1
2
3
4
5
6
7
8
7Z76490.1

Section	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
10	87,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5
9	77,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5
8	67,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
7	57,5	52,8	52,9	53,1	53,5	53,6	53,4	53,0	52,5	52,1	51,9	52,0
6	47,5	64,8	65,2	66,4	67,8	67,9	67,7	66,2	64,0	62,4	61,5	61,2
5	37,5	75,5	76,2	78,1	80,8	81,2	80,7	77,4	73,2	70,3	68,6	68,1
4	27,5	85,0	86,0	88,8	93,6	93,6	92,7	86,6	80,4	76,3	73,9	73,2
3	17,5	93,6	94,7	98,1	104,1	105,3	103,7	93,7	85,8	80,6	77,7	76,9
2	7,5	101,3	102,7	106,9	114,4	116,3	113,8	99,7	89,9	83,6	80,3	79,3
1	0	104,7	106,2	110,3	117,9	120,0	117,2	102,0	91,4	84,8	81,2	80,3

CAPACITANCES

Anode to external conductive coating	$C_{a,g3,g5/m}$	< 750 pF > 300 pF
Anode to metal band	$C_{a,g3,g5/m'}$	100 pF
Cathode to all	C_k	3 pF
Grid 1 to all	C_{g1}	7 pF

FOCUSING	electrostatic
DEFLECTION	magnetic
Diagonal deflection angle	90°
Horizontal deflection angle	82°
Vertical deflection angle	67°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line: 55 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Anode voltage	$V_{a,g3,g5}$	10 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	45 to 65 V

---

* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −100 and + 200 V).

LIMITING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Anode voltage	$V_{a,g3,g5}$	max. min.	14 kV* 8 kV
Grid 4 voltage			
positive	V_{g4}	max.	500 V
negative	$-V_{g4}$	max.	200 V
Grid 2 voltage	V_{g2}	max.	200 V
Cathode voltage			
positive	V_k	max.	200 V
positive peak	V_{kp}	max.	400 V**
negative	$-V_k$	max.	0 V
negative peak	$-V_{kp}$	max.	2 V
Cathode-to-heater voltage	$V_{k/f}$	max.	200 V

CIRCUIT DESIGN VALUES

Grid 4 current			
positive	I_{g4}	max.	25 μA
negative	$-I_{g4}$	max.	25 μA
Grid 2 current			
positive	I_{g2}	max.	5 μA
negative	$-I_{g2}$	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1 MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1 MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5 MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5 MΩ

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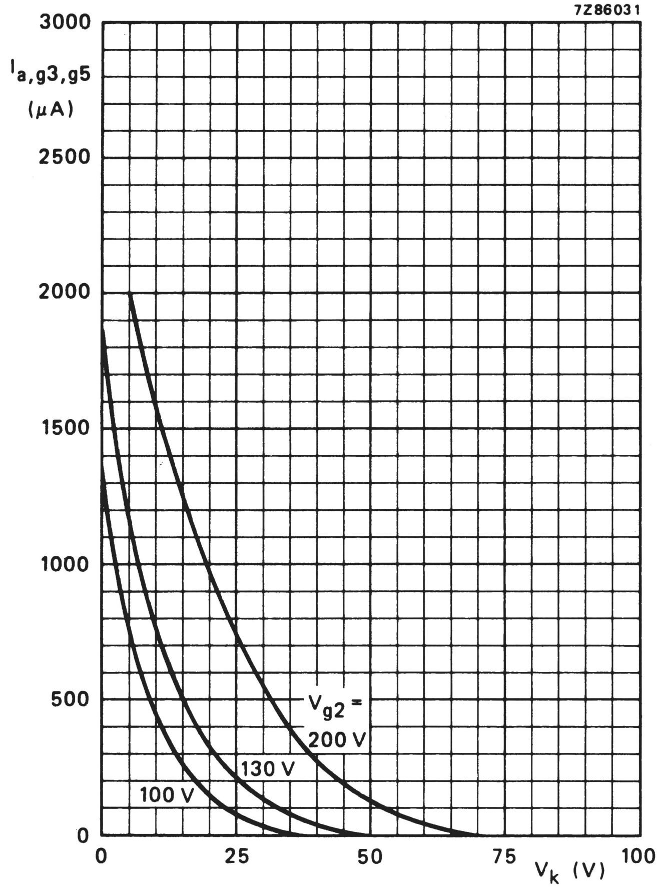
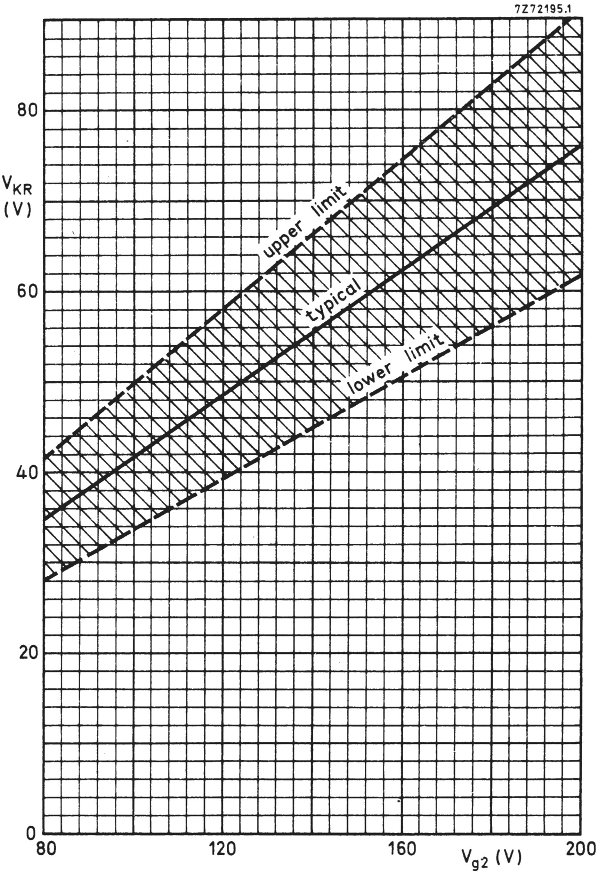
* The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

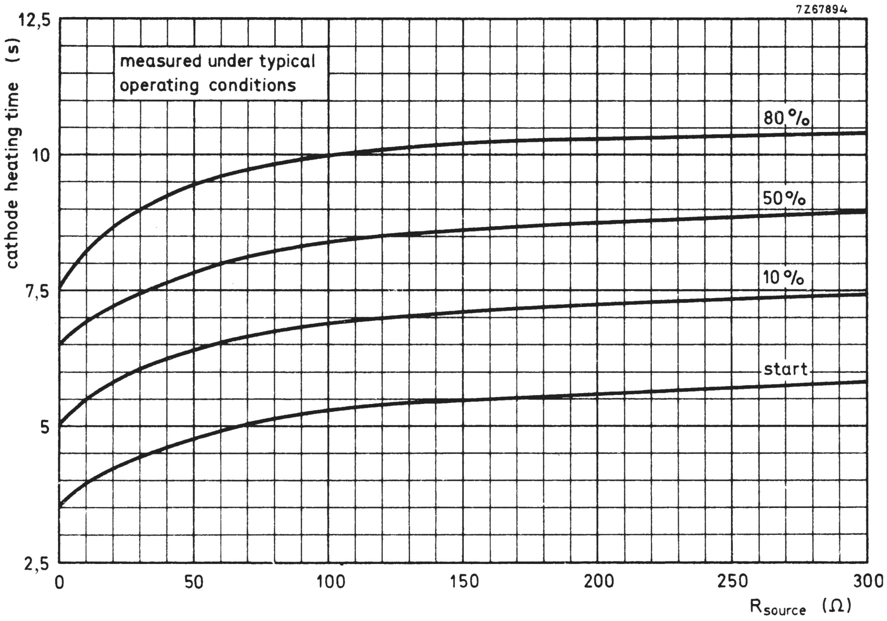


Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal	31 cm (12 in)
Deflection angle	90°
Overall length	max. 280 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Final accelerator voltage	12 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s

SCREEN

Metal-backed phosphor	P4		
Luminescence	white		
Light transmission of face glass		50	%
Useful diagonal	min.	292,2	mm
Useful width	min.	254,1	mm
Useful height	min.	201,7	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V			
Heater current	I_f	140 mA			
Limits (Absolute max. rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. min.	12,7 9,3	V V	*

For heating time as a function of source impedance see last page of this data sheet.

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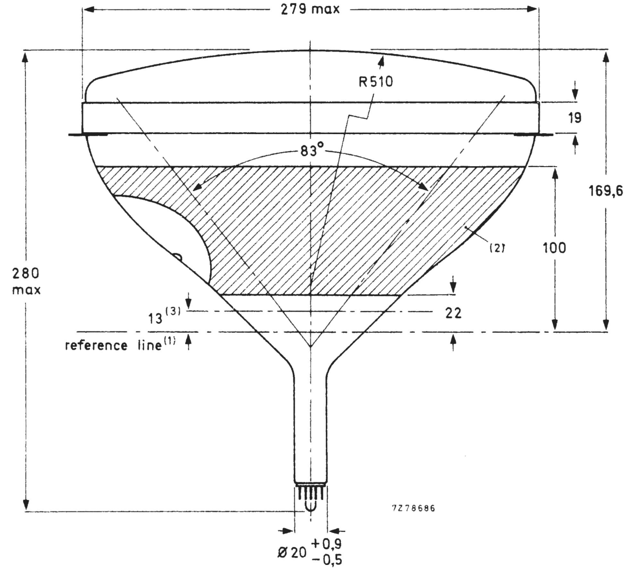
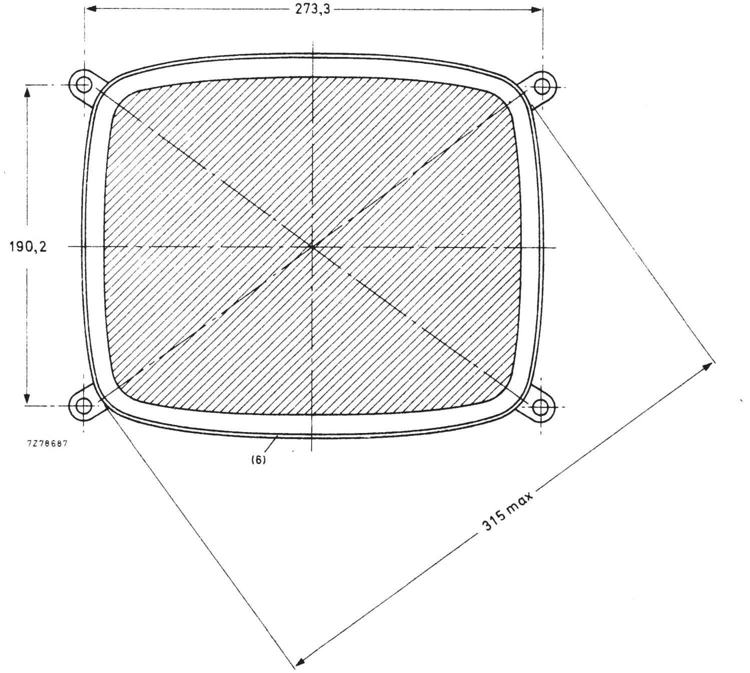
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

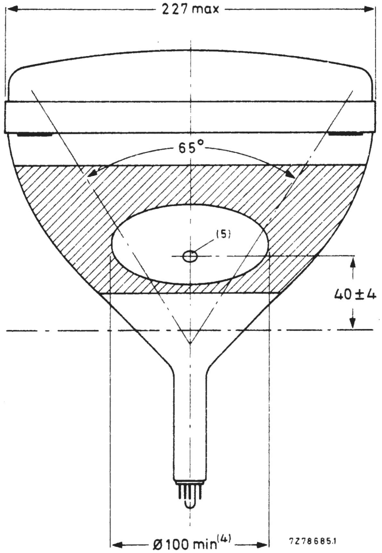
MECHANICAL DATA

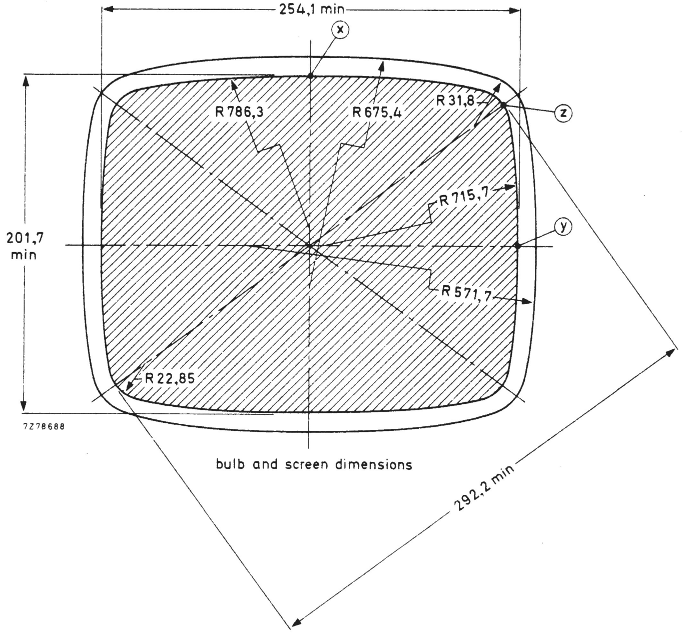
Dimensions in mm

Notes are given after the drawings.

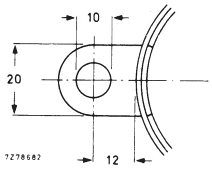

279 max
R510
19
83°
169,6
(2)
100
280
max
13 (3)
22
reference line (1)
7Z78686
ø 20 +0,9 −0,5

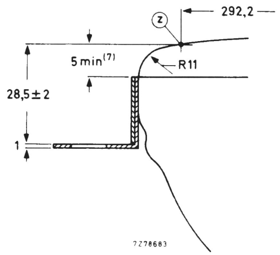

273,3
190,2
7Z78687
(6)
315 max

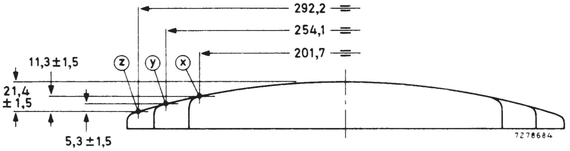

227 max
65°
(5)
40 ± 4
Ø100 min(4)
7Z78685.1

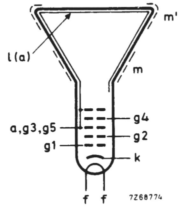

254,1 min
x
R 786,3
R 675,4
R 31,8
z
R 715,7
y
201,7 min
R 571,7
R 22,85
7Z78688
292,2 min

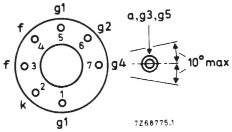
bulb and screen dimensions


10
20
12
7Z78682


z
292,2
5 min(7)
R11
28,5 ± 2
1
7Z78683


292,2
254,1
201,7
11,3 ± 1,5
z
y
x
21,4
± 1,5
5,3 ± 1,5
7Z78684


m'
l(a)
m
g4
a,g3,g5
g2
g1
k
f f
7Z68774


g1
f
g2
5
4
6
f
3
7
g4
2
1
k
g1
a,g3,g5
10° max
7Z68775.1

Mounting position	any
Net mass	approx. 2,9 kg
Base designation	JEDEC E7-91

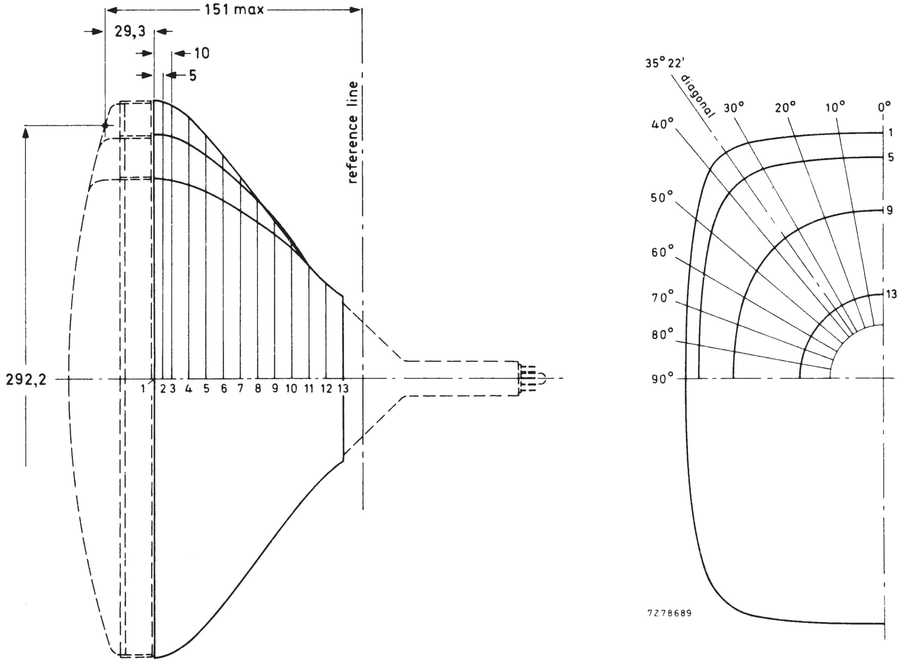
The socket for the base should not be rigidly mounted; it should have flexible leads and be allowed to move freely.

Notes to outline drawings

1. The reference line is determined by the plane of the upper edge of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different but contains the contact area shown in the drawing. The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge D.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2; JEDEC J1-21.
6. The metal band must be earthed.
7. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm


151 max
29,3
10
5
reference line
292,2
1
2
3
4
5
6
7
8
9
10
11
12
13
35° 22'
diagonal
30°
20°
10°
0°
40°
50°
60°
70°
80°
90°
1
5
9
13
7Z78689

Sec-tion	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
13	105,9	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4
12	99	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3
11	90	66,1	66,0	65,8	65,6	65,4	65,4	65,3	65,3	65,3	65,4	65,4
10	80	79,7	79,5	79,0	78,4	78,1	77,8	77,3	76,9	76,6	76,5	76,4
9	70	91,8	92,0	92,1	91,8	91,4	90,9	89,6	87,9	86,2	84,9	84,3
8	60	102,3	103,0	104,2	104,8	104,5	103,9	101,4	97,8	94,4	91,8	90,9
7	50	111,8	112,8	115,1	117,1	117,2	116,5	112,3	106,5	101,3	98,0	96,9
6	40	120,4	121,6	124,9	128,6	129,3	128,5	122,1	113,7	107,3	103,5	102,3
5	30	128,2	129,6	133,7	139,1	140,6	139,6	130,3	119,9	112,6	108,4	107,1
4	20	135,0	136,5	141,3	148,3	150,8	149,4	136,9	125,0	117,1	112,6	111,1
3	10	140,0	141,7	146,8	154,9	158,1	156,3	141,5	128,7	120,3	115,6	114,1
2	5	140,9	142,6	147,9	156,0	159,2	157,3	142,4	129,6	121,1	116,4	114,9
1	0	141,3	143,0	148,3	156,5	159,6	157,6	142,7	129,9	121,5	116,8	115,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,\,g3,\,g5/m}$	< 900 pF > 450 pF
Final accelerator to metal band	$C_{a,\,g3,\,g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Gird 1 to all	C_{g1}	7 pF

FOCUSING

electrostatic

DEFLECTION

magnetic

Diagonal deflection angle	90°
Horizontal deflection angle	83°
Vertical deflection angle	65°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 55 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Final accelerator voltage	$V_{a,\,g3,\,g5}$	12 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	**45 to 65** V

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* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −100 and + 200 V.

LIMITING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Final accelerator voltage	$V_{a, g3, g5}$	max. min.	15 kV* 9 kV
Grid 4 voltage			
positive	V_{g4}	max.	500 V
negative	$-V_{g4}$	max.	200 V
Grid 2 voltage	V_{g2}	max. min.	200 V 80 V
Cathode to grid 1 voltage			
positive	V_k	max.	200 V
positive peak	V_{kp}	max.	400 V**
negative	$-V_k$	max.	0 V
negative peak	$-V_{kp}$	max.	2 V
Cathode-to-heater voltage	$V_{k/f}$	max.	200 V

CIRCUIT DESIGN VALUES

Grid 4 current			
positive	I_{g4}	max.	25 μA
negative	$-I_{g4}$	max.	25 μA
Grid 2 current			
positive	I_{g2}	max.	5 μA
negative	$-I_{g2}$	max.	5 μA

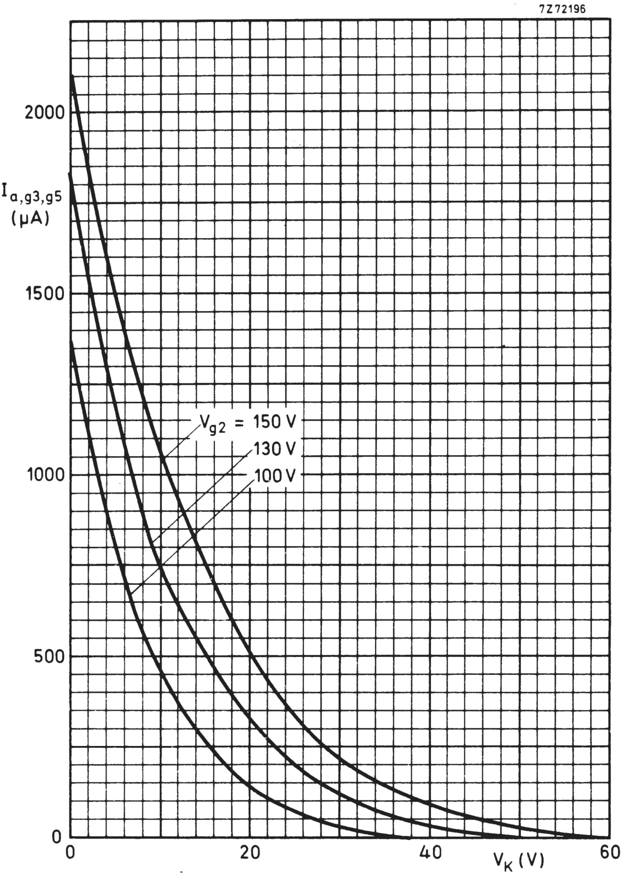
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1 MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1 MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5 MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5 MΩ

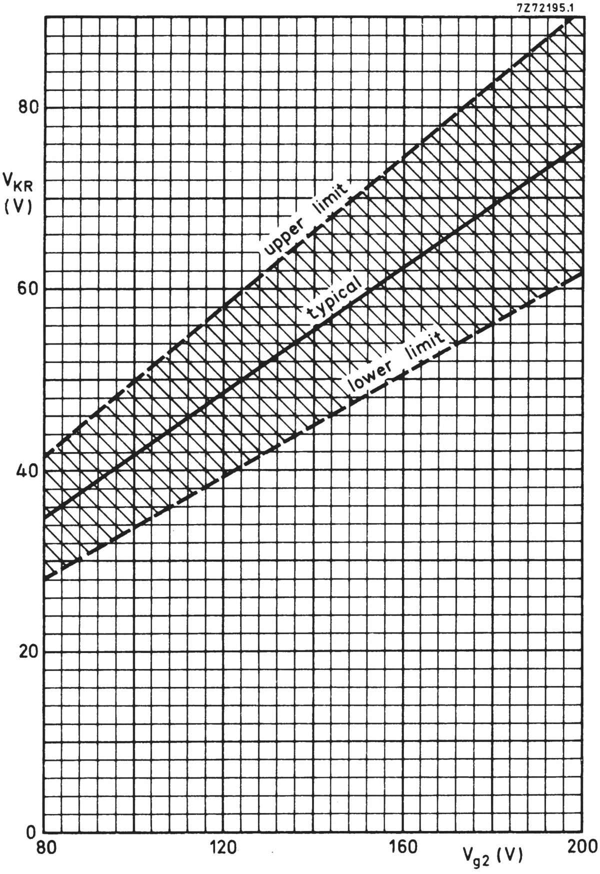
---

* The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

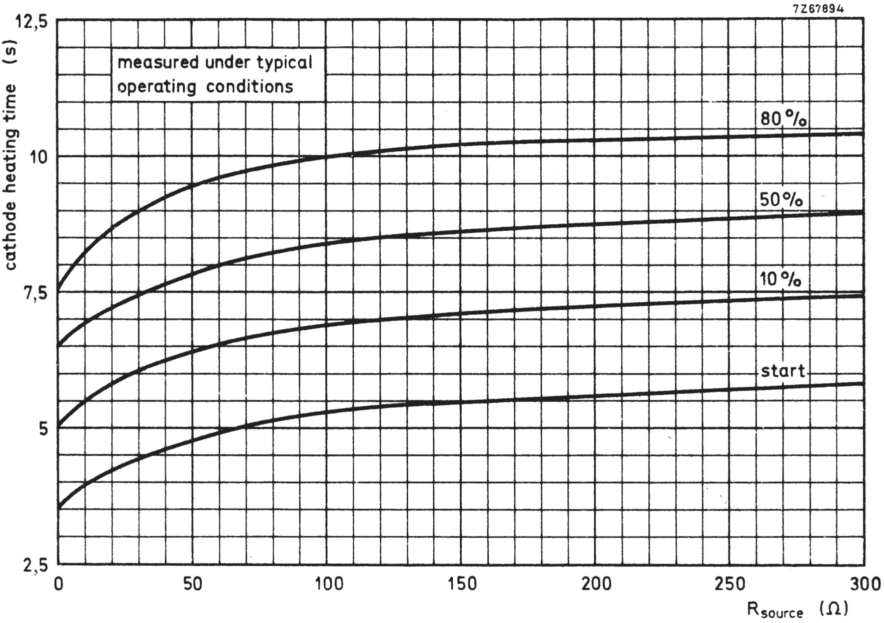


Final accelerator current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA			
Face diagonal		31	cm (12 in)
Deflection angle		110°	
Overall length	max.	233	mm
Neck diameter		20	mm
Heating	11 V,	140	mA
Grid no. 2 voltage		250	V
Final accelerator voltage		12 to 15	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminescence	white		
Light transmission of face glass	≈	50	%
Useful diagonal	≥	295	mm
Useful width	≥	257	mm
Useful height	≥	195	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. min.	12,7 9,3	V V	*)

For heating time as a function of source impedance see last page of this data sheet.

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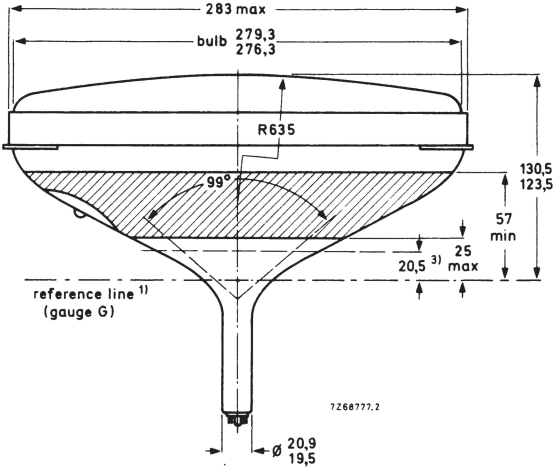
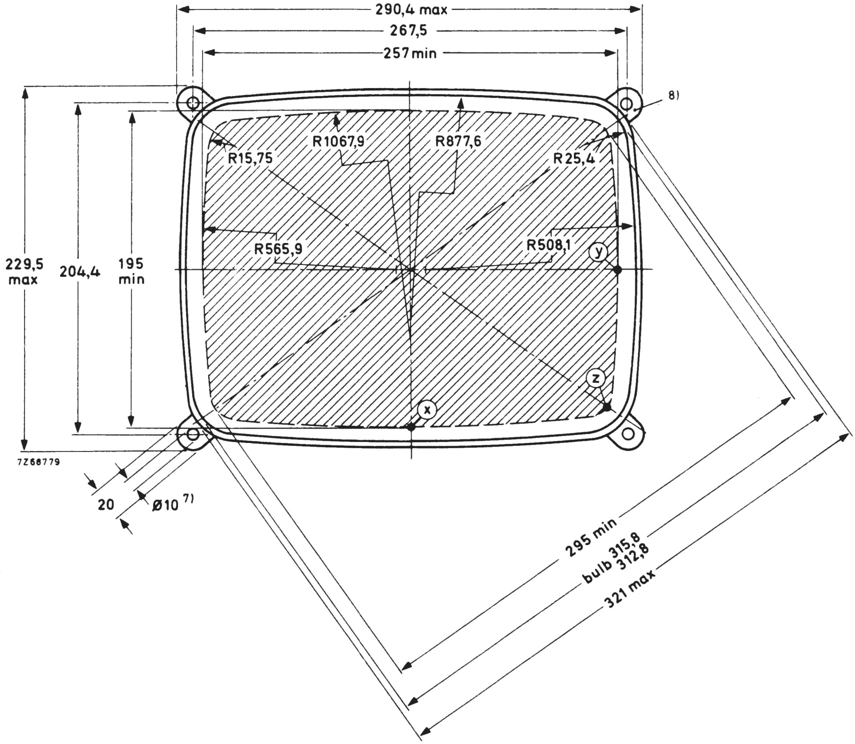
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

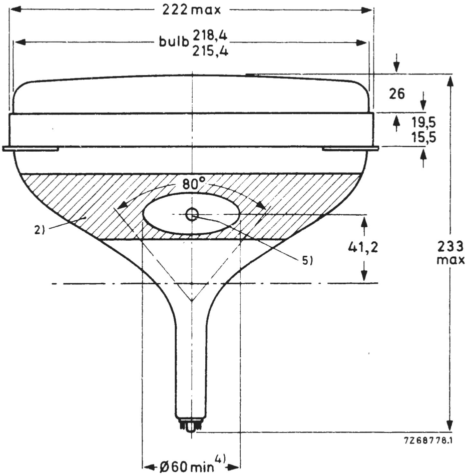
MECHANICAL DATA

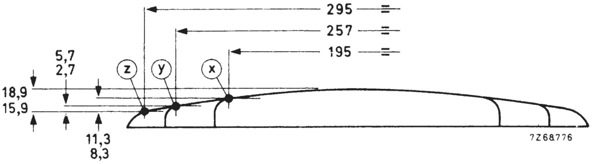
Dimensions in mm

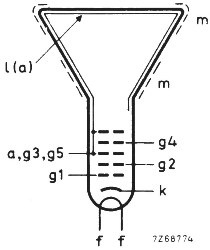
Notes are given after the drawings.

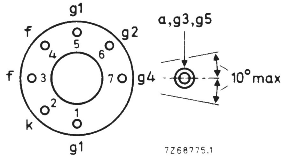

283 max
bulb 279,3 276,3
R635
99°
130,5 123,5
57 min
25 max
20,5 3)
reference line 1)
(gauge G)
7Z68777.2
ø 20,9 19,5

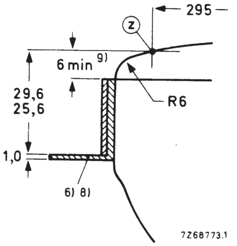

290,4 max
267,5
257 min
8)
R1067,9
R877,6
R15,75
R25,4
R565,9
R508,1
229,5 max
204,4
195 min
y
z
x
7Z68779
20
ø10 7)
295 min
bulb 315,8 312,8
321 max


222 max
bulb 218,4 215,4
26
19,5 15,5
80°
2)
5)
41,2
233 max
7Z68778.1
Ø60 min 4)


295
257
195
5,7 2,7
18,9 15,9
z
y
x
11,3 8,3
7Z68776







Mounting position : any

Net mass : approx. 2,8 kg.

Base : JEDEC E7-91

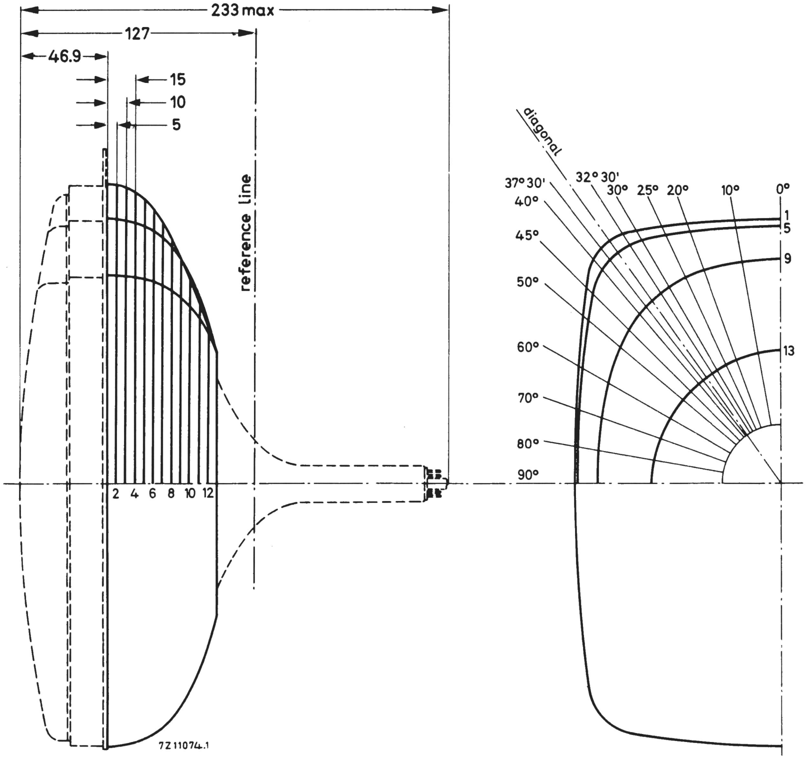
The socket for the base should not be rigidly mounted, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone. (Gauge G).
2. The configuration of the external conductive coating may be different but contains the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm diameter drawn around the true geometrical positions, i.e. at the corners of a rectangle of 267,5 mm x 204,4 mm.
8. The metal band must be earthed.
   Electrical contact between the metal band and the mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Sec-tion	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	38'	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
13	59.6	72,2	72,0	71,7	71,4	71,2	71,1	71,0	71,0	70,9	70,8	70,7	70,6	70,7	70,8	70,8
12	55	85,9	85,6	84,9	84,4	84,0	83,8	83,5	83,3	83,1	82,7	82,4	81,9	81,6	81,5	81,5
11	50	99,5	99,4	98,9	98,5	97,9	97,5	97,1	96,8	96,3	95,4	94,4	92,4	90,7	89,5	89,1
10	45	112,3	112,4	112,2	111,7	110,9	110,4	109,7	109,1	108,3	106,6	104,7	100,9	97,7	95,5	94,7
9	40	121,3	121,3	122,8	122,9	122,4	121,9	121,2	120,5	119,5	117,1	114,3	108,6	103,8	100,8	99,7
8	35	127,9	128,9	131,2	132,1	140,8	132,3	131,7	130,9	129,7	126,5	122,7	114,9	108,8	105,0	103,7
7	30	132,6	134,0	137,4	139,3	147,2	141,2	140,9	140,2	138,8	134,6	129,5	119,7	112,5	108,2	106,8
6	25	136,0	137,5	141,7	144,4	151,6	148,3	148,5	147,9	146,5	140,9	134,3	122,9	115,0	110,5	109,0
5	20	138,4	140,0	144,5	147,8	154,6	153,2	153,7	153,2	151,7	144,8	137,1	124,7	116,5	111,8	110,3
4	15	140,3	141,9	146,6	150,2	156,5	156,6	157,4	156,9	155,1	147,1	138,5	125,4	117,0	112,3	110,8
3	10	141,6	143,2	148,0	151,8	154,6	158,7	159,5	159,0	157,1	148,5	139,4	126,0	117,6	112,9	111,4
2	5	142,4	143,9	148,8	152,6	157,4	159.5	160,7	160,2	158,2	149,4	140,1	126,6	118,1	113,4	111,9
1	0	142,8	144,4	149,3	153,1	157,9	160,2	161,1	160.6	158,7	149,9	140,6	127,1	118,5	113,8	112,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	$<$ 900 pF $>$ 450 pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Grid no. 1 to all	C_{g1}	7 pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	99°
Vertical deflection angle	80°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line : 47 mm.

TYPICAL OPERATING CONDITIONS

Grid drive service

Final accelerator voltage	$V_{a, g3, g5}$	12 to 15	kV
Focusing electrode voltage	V_{g4}	0 to 350	V 1)
Grid no. 2 voltage	V_{g2}	250	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	-35 to -69	V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a, g3, g5}$	12 to 15	kV
Focusing electrode voltage	V_{g4}	0 to 350	V 1)
Grid no. 2 voltage	V_{g2}	250	V
Cathode voltage for visual extinction of focused raster	V_{KR}	32 to 58	V

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1) Individual tubes will have optimum focus within this range. In general an acceptable picture will be obtained with a fixed focus voltage.

LIMITING VALUES (Design max. rating system)

→ Final accelerator voltage	$V_{a,g3,g5}$	max. min.	17 9	kV*) kV
Grid No. 4 voltage				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	50	V
Grid No. 2 voltage	V_{g2}	max. min.	350 200	V V
Grid No. 2 to grid No. 1 voltage	$V_{g2/g1}$	max.	450	V
Cathode to grid No. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid No. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid No. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

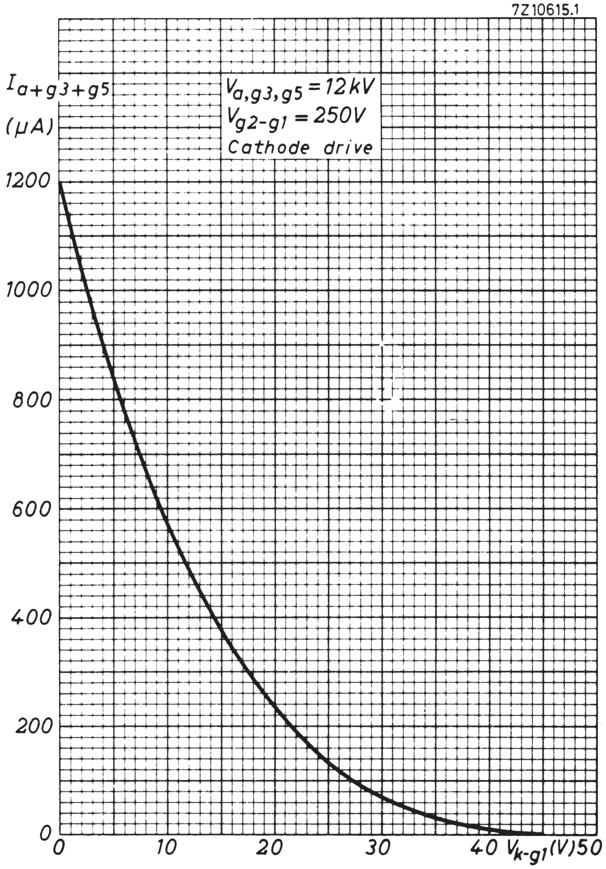
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0, 1	MΩ
Grid No. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid No. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0, 5	MΩ

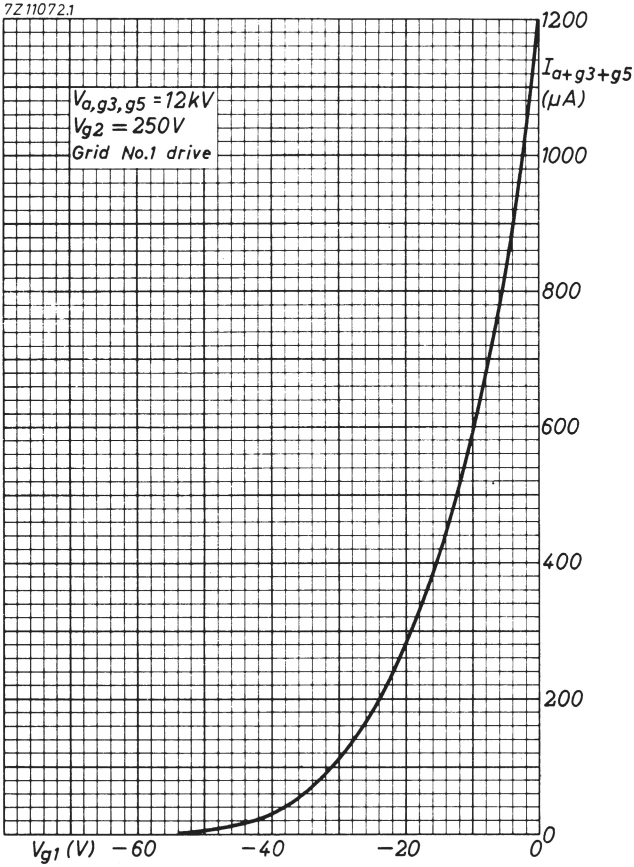
---

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

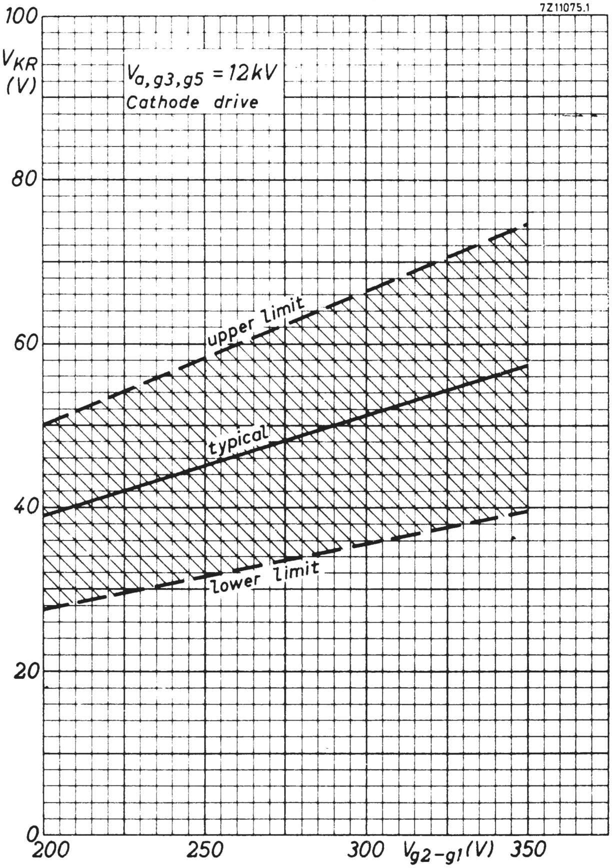
**) Maximum pulse duration 22% of a cycle but max. 1, 5 ms.



Final accelerator current as a function of cathode voltage

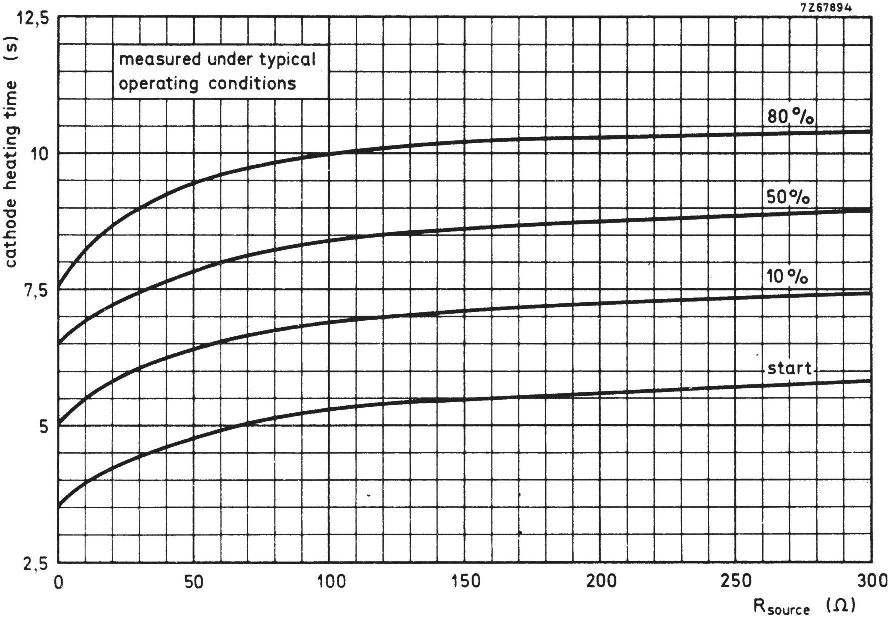


Final accelerator voltage as a function of grid no. 1 voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal		31	cm (12 in)
Deflection angle		110 °	
Overall length	max.	233	mm
Neck diameter		20	mm
Heating	11 V ,	140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		12 to 15	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor

Luminescence	white		
Light transmission of face glass	≈	50	%
Useful diagonal	≥	295	mm
Useful width	≥	257	mm
Useful height	≥	195	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11	V
Heater current	I_f	140	mA

Limits (Absolute max. rating system) of r.m.s. heater voltage	V_f	max.	12,7	V *)
		min.	9,3	V

For heating time as a function of source impedance see last page of this data sheet.

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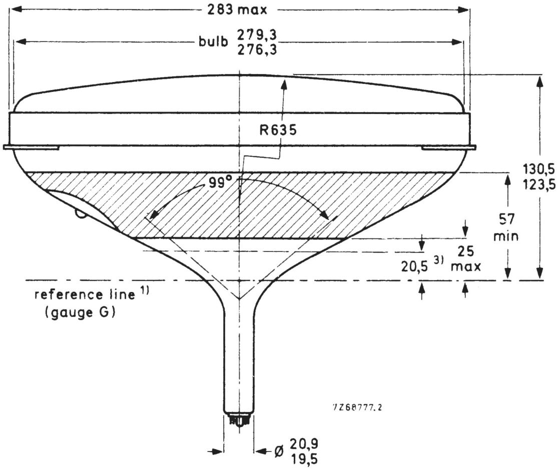
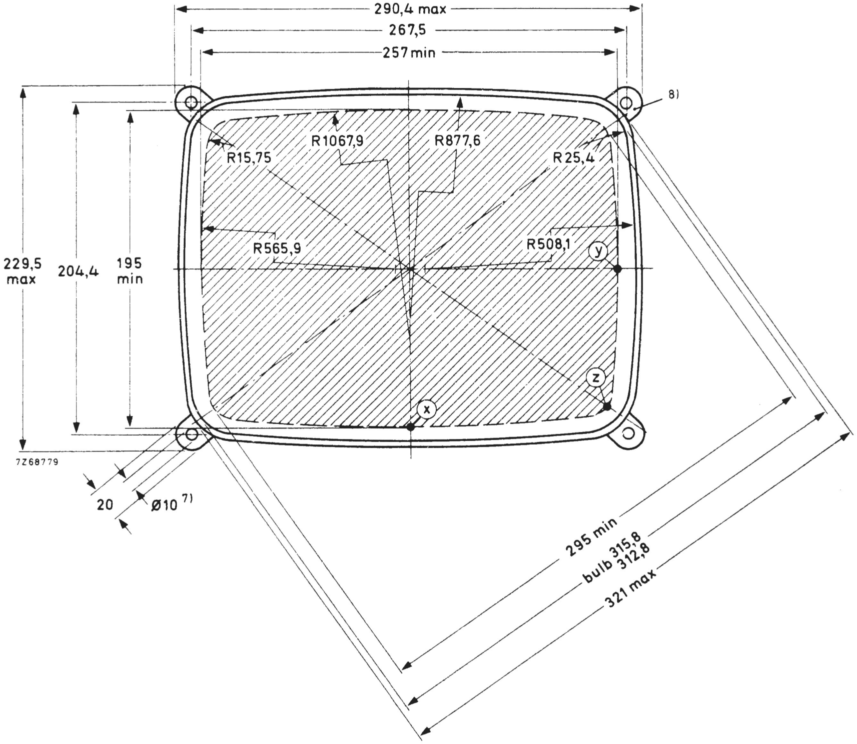
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

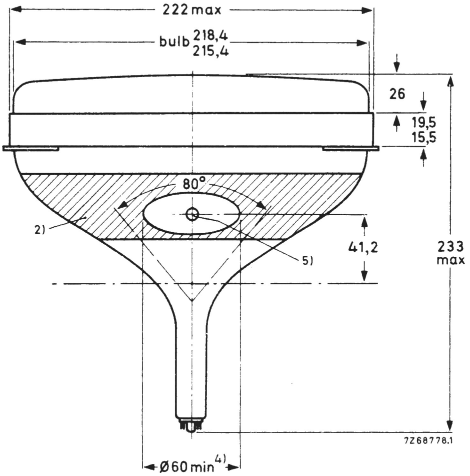
MECHANICAL DATA

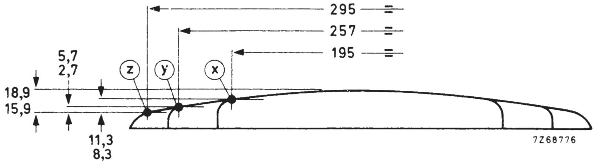
Dimensions in mm

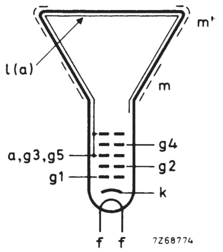
Notes are given after the drawings.

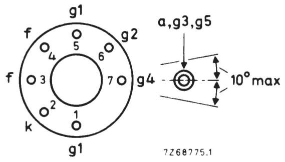

283 max
bulb 279,3 276,3
R635
99°
130,5 123,5
57 min
25 max
20,5 3)
reference line 1) (gauge G)
7Z68777.2
Ø 20,9 19,5

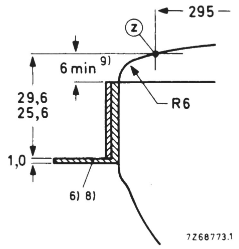

290,4 max
267,5
257 min
8)
R15,75
R1067,9
R877,6
R25,4
R565,9
R508,1
y
z
x
229,5 max
204,4
195 min
7Z68779
20
Ø10 7)
295 min
bulb 315,8 312,8
321 max


222 max
bulb 218,4 215,4
26
19,5
15,5
80°
2)
5)
41,2
233 max
7Z68778.1
Ø60 min 4)


295
257
195
5,7
2,7
z
y
x
18,9
15,9
11,3
8,3
7Z68776







Mounting position : any

Net mass : approx. 2,8 kg

Base : JEDEC E7-91

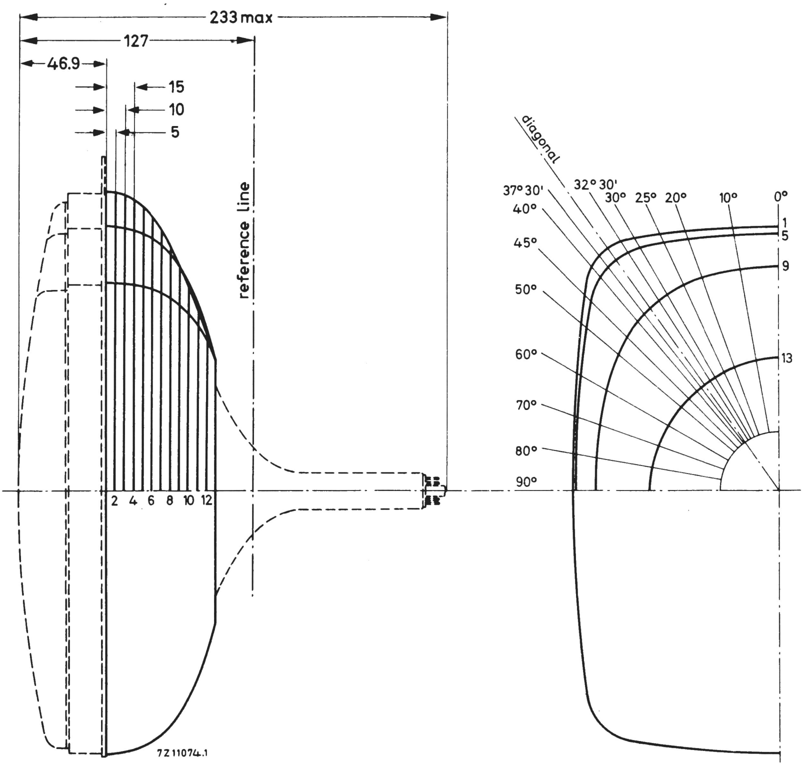
The socket for this base should not be mounted rigidly, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (Gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm diameter drawn around the true geometrical positions, i.e. at the corners of a rectangle of 267,5 mm x 204,4 mm.
8. Electrical contact between the metal band and the mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Sec-tion	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	38'	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
13	59.6	72,2	72,0	71,7	71,4	71,2	71,1	71,0	71,0	70,9	70,8	70,7	70,6	70,7	70,8	70,8
12	55	85,9	85,6	84,9	84,4	84,0	83,8	83,5	83,3	83,1	82,7	82,4	81,9	81,6	81,5	81,5
11	50	99,5	99,4	98,9	98,5	97,9	97,5	97,1	96,8	96,3	95,4	94,4	92,4	90,7	89,5	89,1
10	45	112,3	112,4	112,2	111,7	110,9	110,4	109,7	109,1	108,3	106,6	104,7	100,9	97,7	95,5	94,7
9	40	121,3	121,3	122,8	122,9	122,4	121,9	121,2	120,5	119,5	117,1	114,3	108,6	103,8	100,8	99,7
8	35	127,9	128,9	131,2	132,1	140,8	132,3	131,7	130,9	129,7	126,5	122,7	114,9	108,8	105,0	103,7
7	30	132,6	134,0	137,4	139,3	147,2	141,2	140,9	140,2	138,8	134,6	129,5	119,7	112,5	108,2	106,8
6	25	136,0	137,5	141,7	144,4	151,6	148,3	148,5	147,9	146,5	140,9	134,3	122,9	115,0	110,5	109,0
5	20	138,4	140,0	144,5	147,8	154,6	153,2	153,7	153,2	151,7	144,8	137,1	124,7	116,5	111,8	110,3
4	15	140,3	141,9	146,6	150,2	156,5	156,6	157,4	156,9	155,1	147,1	138,5	125,4	117,0	112,3	110,8
3	10	141,6	143,2	148,0	151,8	154,6	158,7	159,5	159,0	157,1	148,5	139,4	126,0	117,6	112,9	111,4
2	5	142,4	143,9	148,8	152,6	157,4	159,5	160,7	160,2	158,2	149,4	140,1	126,6	118,1	113,4	111,9
1	0	142,8	144,4	149,3	153,1	157,9	160,2	161,1	160,6	158,7	149,9	140,6	127,1	118,5	113,8	112,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	< 900 > 450	pF pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$	150	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	99°
Vertical deflection angle	80°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no.1

Final accelerator voltage	$V_{a,g3,g5}$	12 to 15	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no.2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

---

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and +130 V (e.g. two taps; 0 V and 130 V).
The optimum focusing voltage of individual tubes may be between -100 V and +200 V.

LIMITING VALUES (Design max. rating system)

→ Final accelerator voltage	$V_{a,g3,g5}$	max. min.	17 9	kV*) kV
Grid no. 4 voltage				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	V_{g2}	max.	200	V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1_p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1_p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

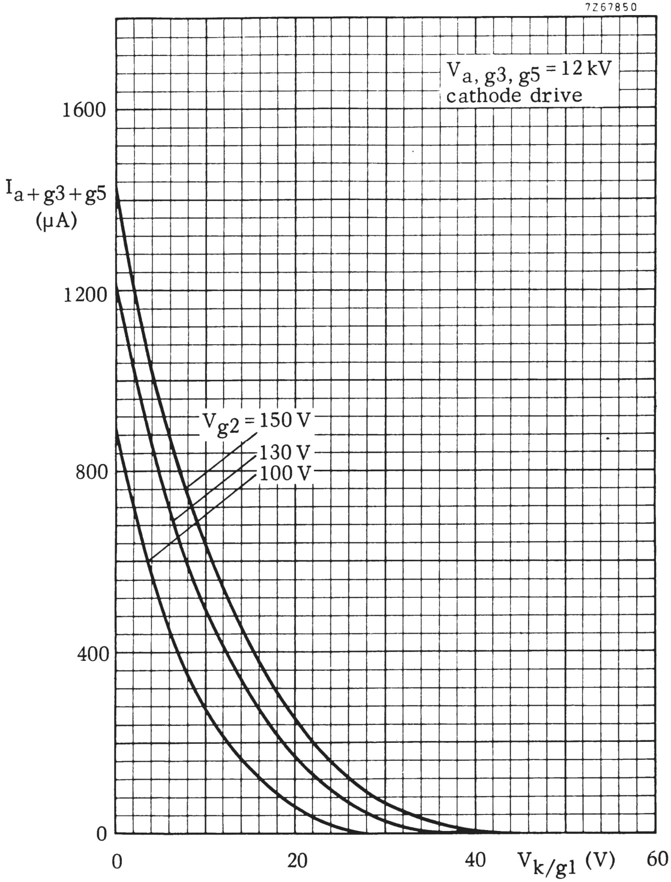
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50Hz)	max.	0,5	MΩ

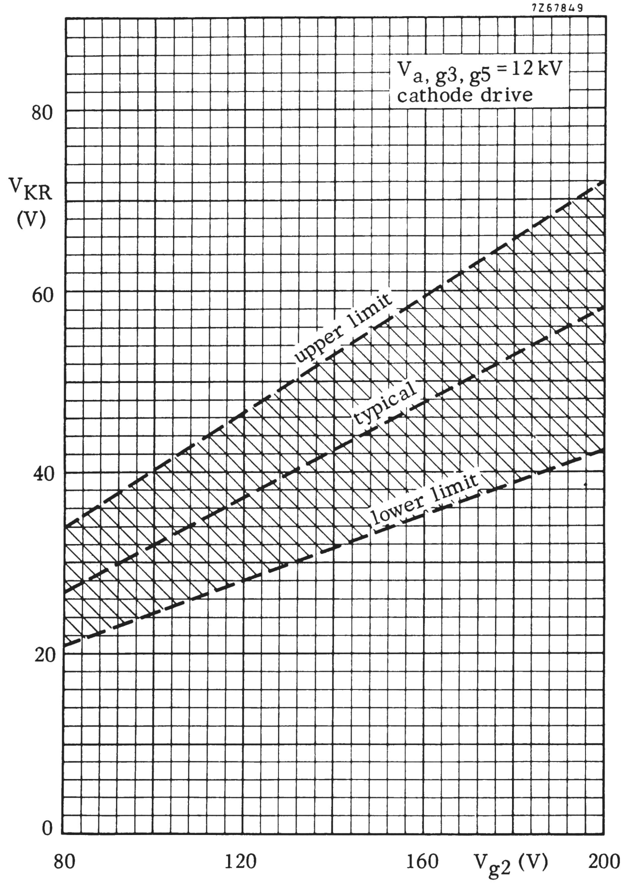
---

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1,5 ms.

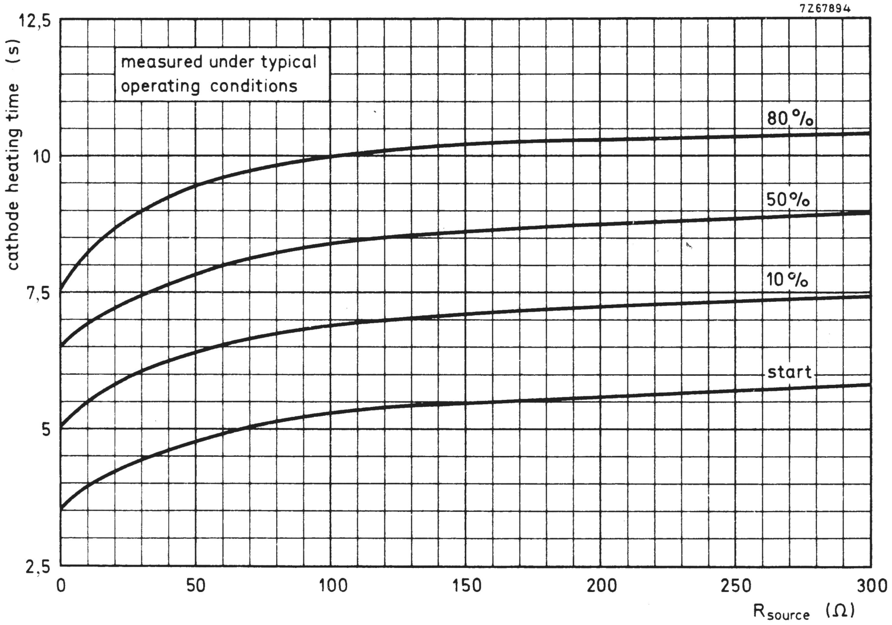


Final accelerator current as a function of cathode voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no.2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

34 cm (14 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal	34 cm (14 in)
Deflection angle	90°
Overall length	max. 287 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Anode voltage	12 to 15 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s

SCREEN

Metal-backed phosphor	P4
Luminescence	white
Light transmission of face glass	48%
Useful diagonal	min. 322 mm
Useful width	min. 270 mm
Useful height	min. 210 mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V
Heater current	I_f	140 mA
Limits (Absolute maximum rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. 12,7 V* min. 9,3 V

For heating time as a function of source impedance see last page of this data sheet.

---

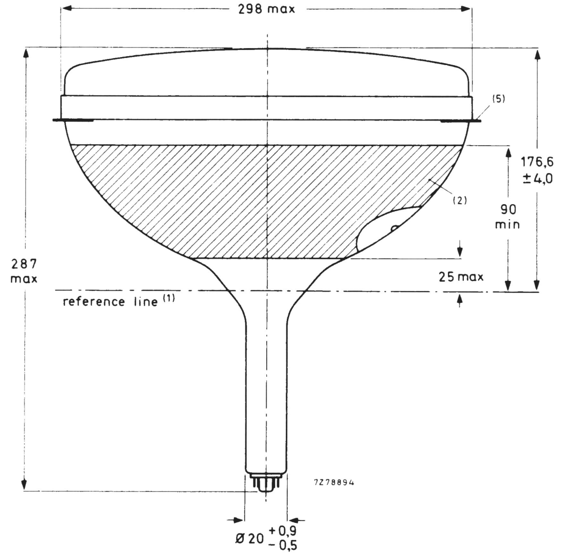
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

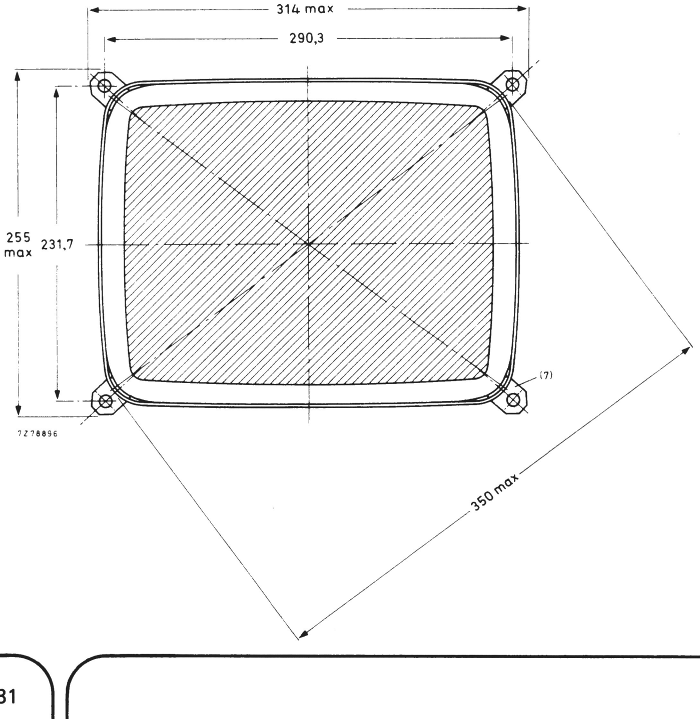
For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

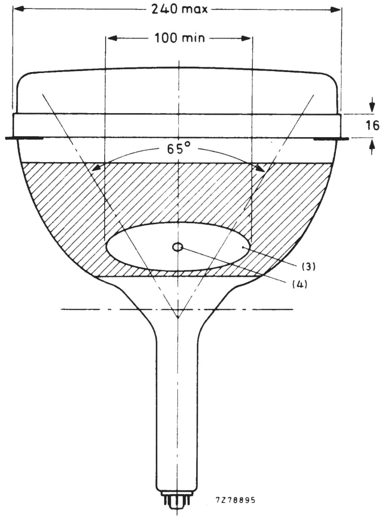
MECHANICAL DATA

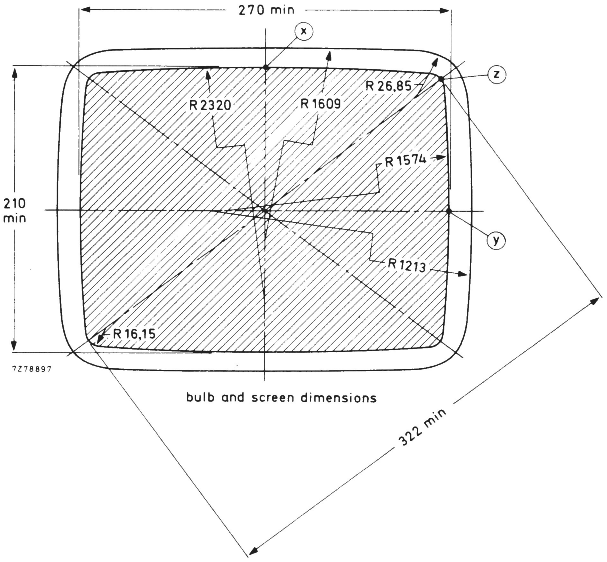
Dimensions in mm

Notes are given after the drawings

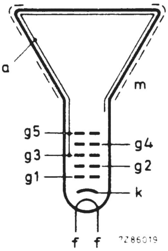

298 max
(5)
176,6
±4,0
(2)
90
min
287
max
25 max
reference line (1)
7Z78894
Ø 20 +0,9 −0,5

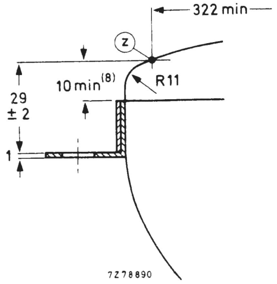

314 max
290,3
255
max
231,7
(7)
7Z78896
350 max

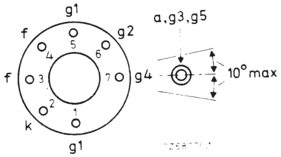

240 max
100 min
16
65°
(3)
(4)
7Z78895

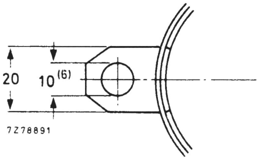

270 min
x
z
R 26,85
R 2320
R 1609
R 1574
210 min
y
R 1213
R 16,15
7Z78897
322 min

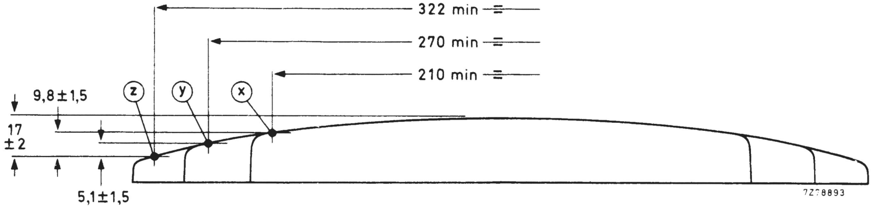
bulb and screen dimensions


a
m
g5
g3
g1
g4
g2
k
f
f
7Z86019


322 min
z
10 min(8)
R11
29 ± 2
1
7Z78890


g1
f
g2
a,g3,g5
5
4
6
f
3
7
g4
10° max
2
1
k
g1


20
10 (6)
7Z78891


322 min
270 min
210 min
9,8 ± 1,5
z
y
x
17 ± 2
5,1 ± 1,5
7Z78893

Mounting position	any
Nett mass	approx. 3,6 kg
Bulb contact designation	IEC 67-III-2; JEDEC J1-21
Base designation	JEDEC E7-91
Basing	7GR

The socket for this base should not be mounted rigidly; it should have flexible leads and be allowed to move freely.

Notes to outline drawings on the preceding pages

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing. The external conductive coating must be earthed.
3. This area must be kept clean.
4. Recessed cavity contact IEC67-III-2.
5. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
6. The mounting screws in the cabinet must be situated inside a circle of 7 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 290,3 mm x 231,7 mm.
7. Electrical contact between the metal band and mounting lugs is guaranteed.
8. Distance from reference point Z to any hardware.

CAPACITANCES

Anode to external conductive coating	$C_{a,g3,g5/m}$	$<$ 1100 pF $>$ 450 pF
Anode to metal band	$C_{a,g3,g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Grid 1 to all	C_{g1}	7 pF

FOCUSING	electrostatic

DEFLECTION	magnetic
Diagonal deflection angle	90°
Horizontal deflection angle	82°
Vertical deflection angle	67°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line: 47 mm

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Anode voltage	$V_{a,g3,g5}$	12 to 15 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	45 to 65 V

---

* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −100 and + 200 V).

LIMTING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Anode voltage	$V_{a,g3,g5}$	max. min.	17 9	kV* kV
Grid 4 voltage				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	200	V
Grid 2 voltage	V_{g2}	max.	200	V
Cathode voltage				
positive	V_k	max.	200	V
positive peak	V_{kp}	max.	400	V**
negative	$-V_k$	max.	0	V
negative peak	$-V_{kp}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

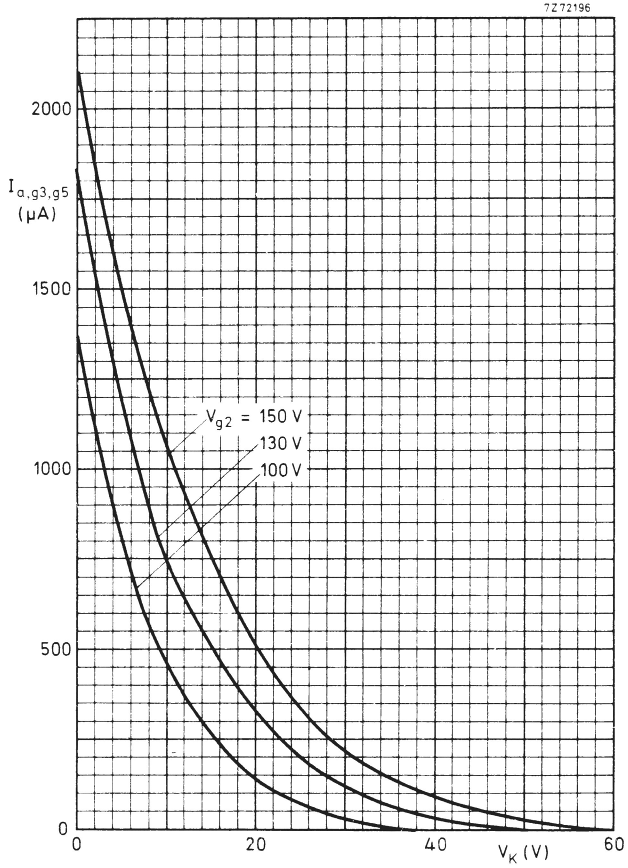
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

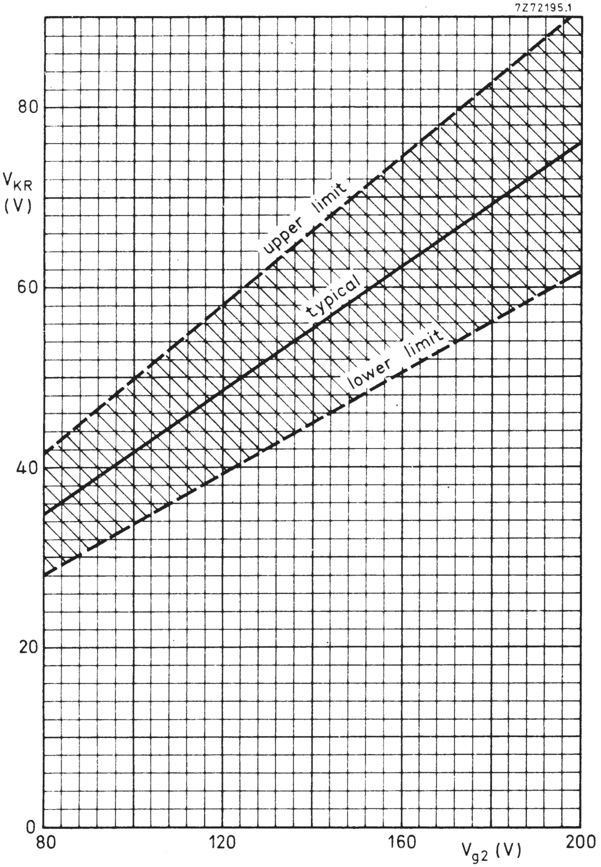
---

* The X-ray dose rate remains below the accpetable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

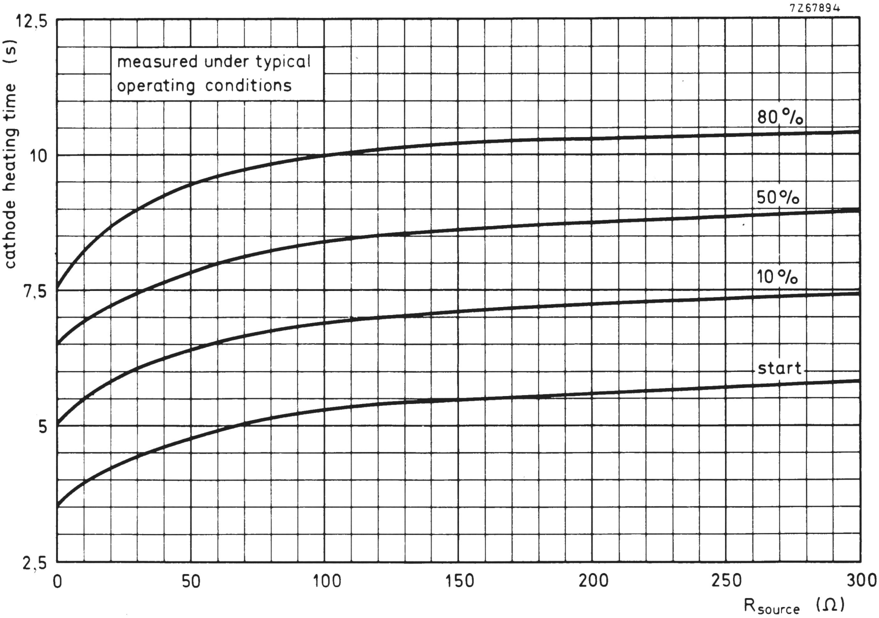


Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 15 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 15 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

34 cm (14 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.
The tube is designed for "push through" application and is provided with four metal lugs for mounting into a cabinet.

QUICK REFERENCE DATA			
Face diagonal		34	cm (14 in)
Deflection angle		110°	
Overall length	max.	247	mm
Neck diameter		20	mm
Heating		11 V, 140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		12 to 15	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminance	white		
Light transmission of face glass	≈	48	%
Useful diagonal	≥	322, 3	mm
Useful width	≥	270, 2	mm
Useful height	≥	210, 7	mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	12,7 9,3	V V	*)

For heating time as a function of source impedance see last page of this data sheet.

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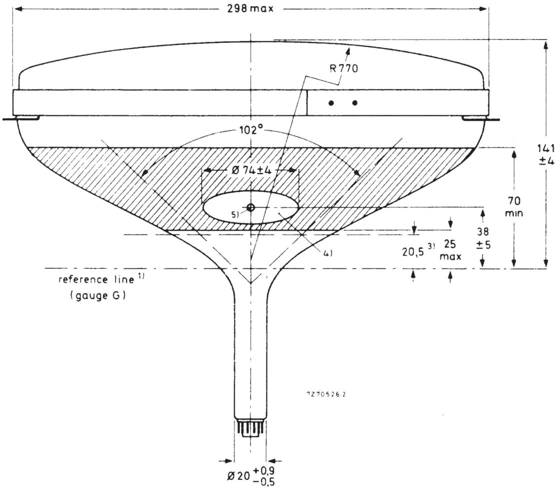
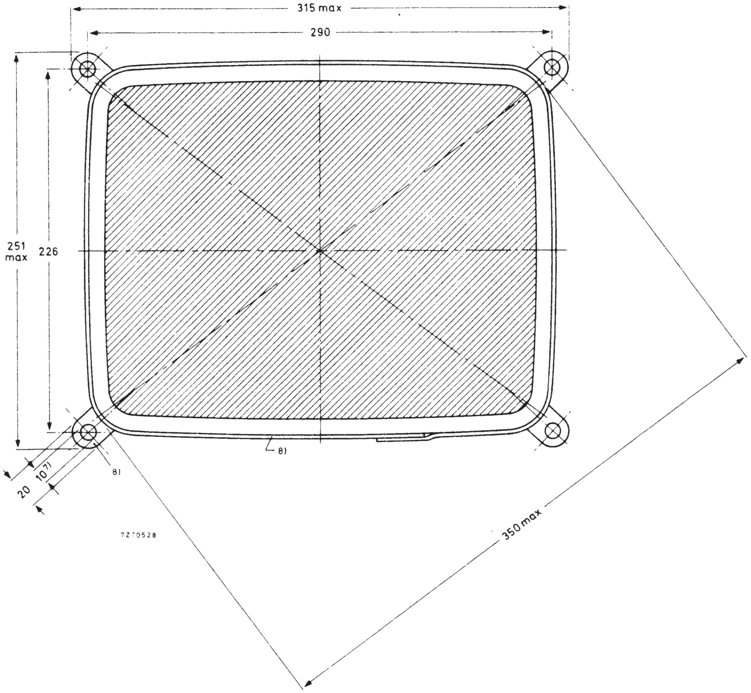
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

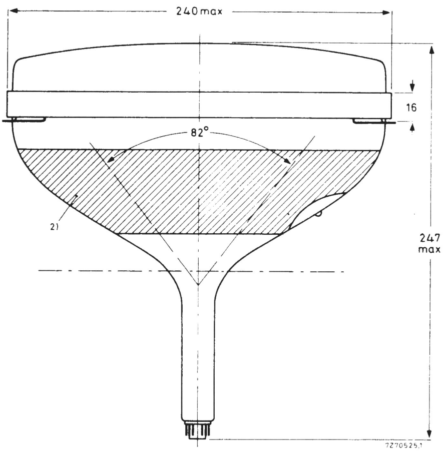
MECHANICAL DATA

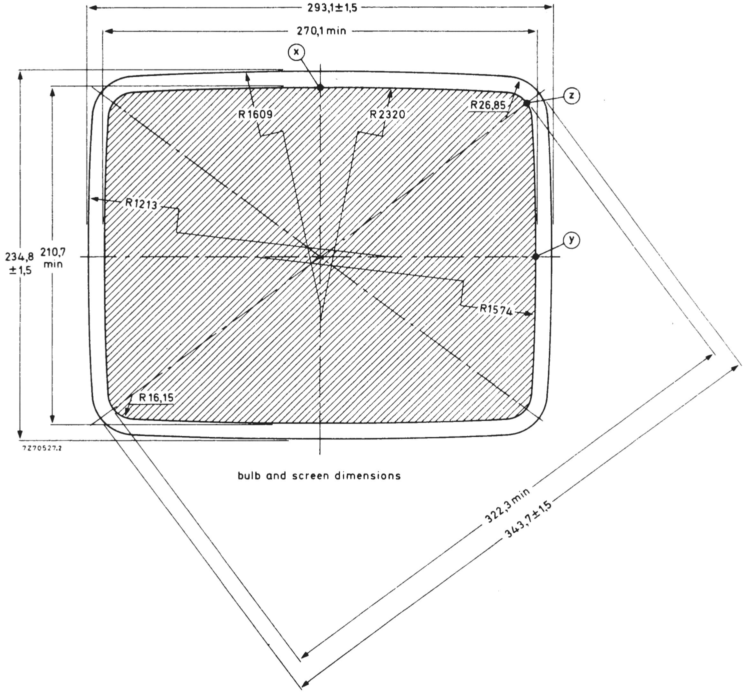
Dimensions in mm

Notes are given after the drawings.

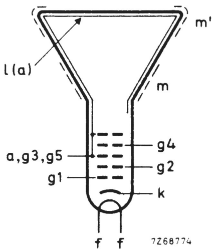

298 max
R770
102°
Ø 74±4
5)
4)
141 ±4
70 min
38 ±5
20,5 3)
25 max
reference line 1)
(gauge G)
7Z70526.2
Ø 20 +0,9 −0,5

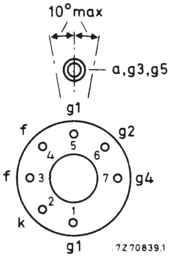

315 max
290
251 max
226
20
10 7)
8)
8)
7Z70528
350 max

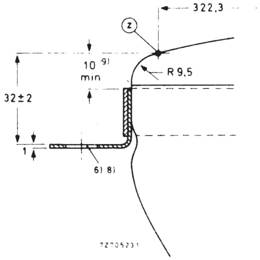

240 max
16
82°
2)
247
max
7Z70525.1

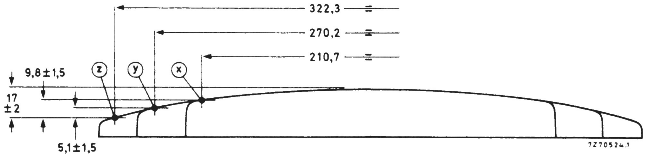

293,1±1,5
270,1 min
x
z
y
R1609
R2320
R26,85
R1213
R1574
R16,15
234,8
±1,5
210,7
min
322,3 min
343,7±1,5
7Z70527.2

bulb and screen dimensions


l(a)
m'
m
a,g3,g5
g1
g4
g2
k
f f
7Z68774


10° max
a,g3,g5
g1
f
f
k
g2
g4
g1
1
2
3
4
5
6
7
7Z70839.1


322,3
z
10 9)
min
R 9,5
32±2
1
6) 8)
7Z70523.1


322,3
270,2
210,7
9,8±1,5
17
±2
5,1±1,5
z
y
x
7Z70524.1

Mounting position : any

Netmass : approx. 3,2 kg

Base : JEDEC E7-91

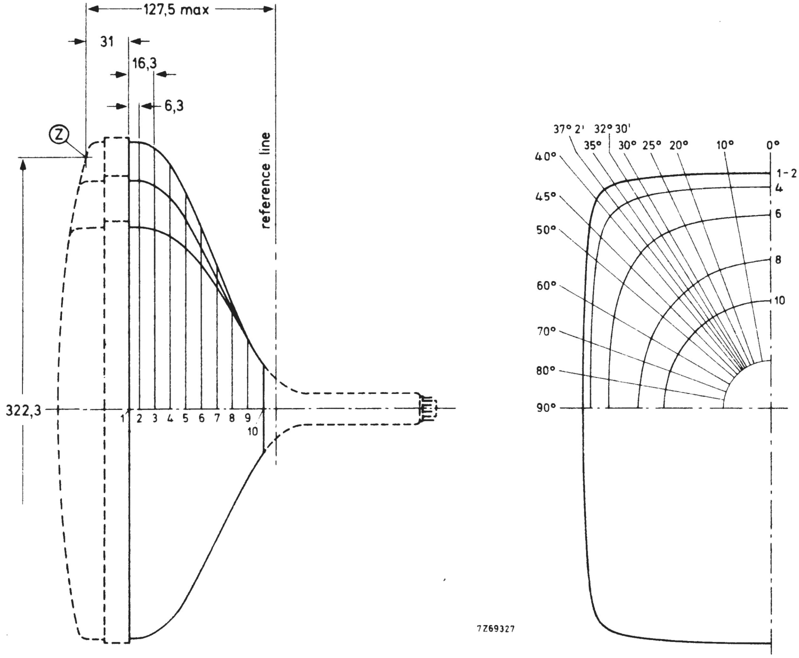
The socket for this base should not be mounted rigidly it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 290 mm x 226 mm.
8. Electrical contact between the metal band and mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm


127,5 max
31
16,3
6,3
Z
reference line
322,3
1
2
3
4
5
6
7
8
9
10
7Z69327
37° 2'
32° 30'
35°
30°
25°
20°
10°
0°
40°
45°
50°
60°
70°
80°
90°
1-2
4
6
8
10

Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	35°	37°2'	40°	45°	50°	60°	70°	80°	90°
1	0	150,6	152,7	159,3	164,4	170,4	173,4	175,7	176,5	174,8	165,3	154,6	138,6	128,6	123,2	121,4
2	6,3	150,6	152,7	159,3	164,4	170,4	173,4	175,7	176,5	174,8	165,3	154,6	138,6	128,6	123,2	121,4
3	16,3	148,1	150,2	156,6	161,6	167,6	170,6	173,0	173,9	172,6	163,7	153,2	137,3	127,4	121,9	120,2
4	26,3	141,6	143,5	149,3	153,6	158,3	160,3	161,8	162,2	161,3	155,5	147,2	132,8	123,5	118,3	116,7
5	36,3	133,5	135,2	139,9	142,9	145,7	146,7	147,3	147,3	146,4	142,8	137,4	126,1	117,7	113,0	111,5
6	46,3	124,0	125,3	128,5	130,1	131,2	131,4	131,4	131,1	130,3	127,9	124,6	116,9	110,3	106,2	104,9
7	56,3	112,2	113,0	114,1	114,3	114,2	114,0	113,6	113,2	112,5	110,0	109,1	104,7	100,7	97,8	96,7
8	66,3	95,8	95,6	95,6	94,6	93,9	93,6	93,2	92,9	92,4	91,5	90,6	88,9	87,4	86,3	85,9
9	71,3	84,5	84,1	83,3	82,8	82,2	81,9	81,7	81,4	81,1	80,6	80,1	79,3	78,8	78,5	78,5
10	76,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	<900 >450	pF pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	200	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	102°
Vertical deflection angle	82°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1.

Final accelerator voltage	$V_{a, g3, g5}$	12 to 15	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

---

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 V and +130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between −100 V and +200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	17 9	kV*) kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	V_{g2}	max.	200	V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

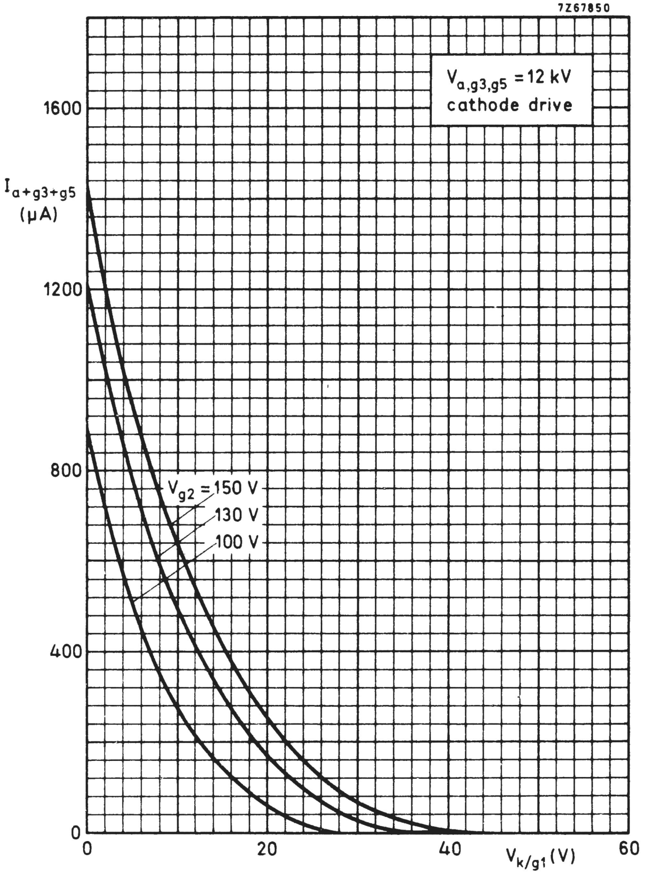
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0, 5	MΩ

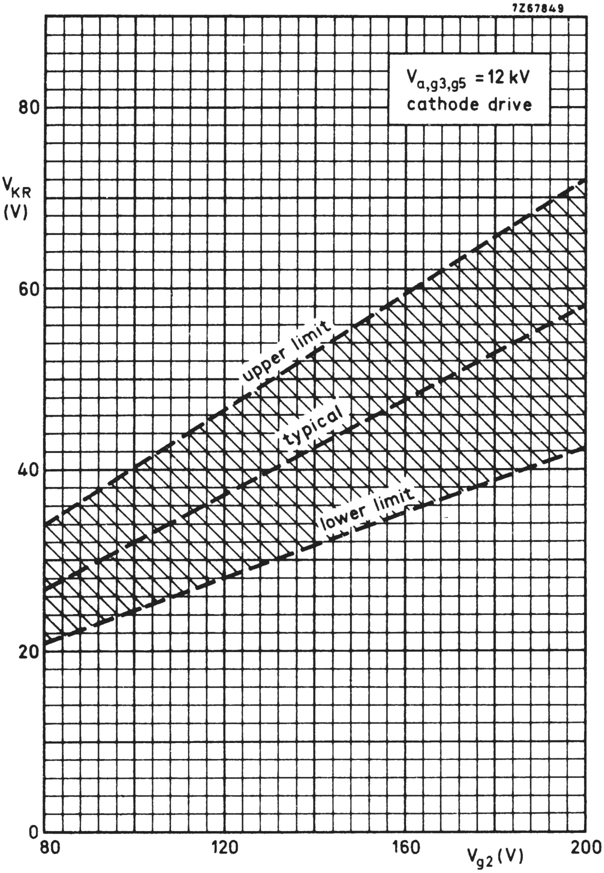
---

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1, 5 ms.

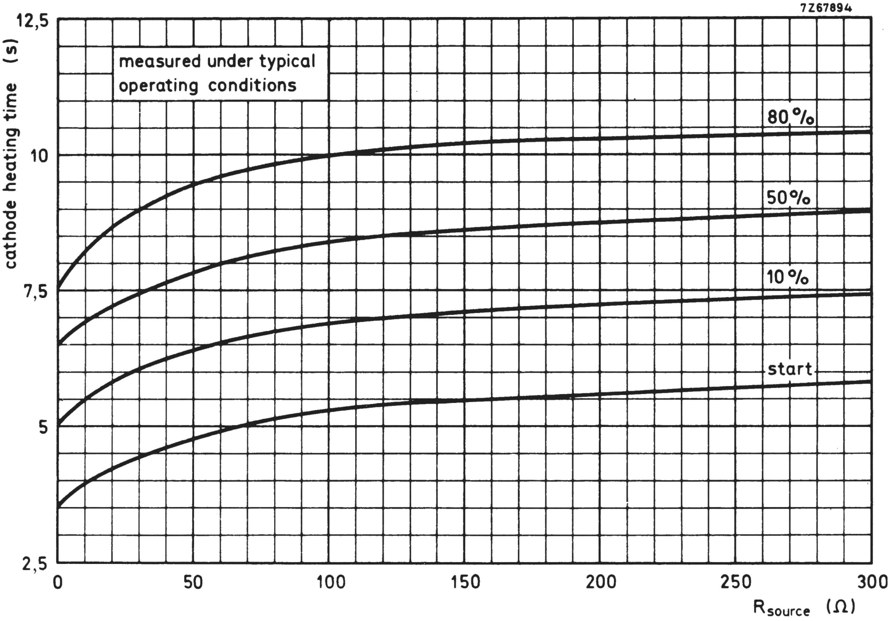


Final accelerator current as a function of cathode voltage.



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

44 cm (17 in), 110°, rectangular direct vision picture tube with integral protection for black-and-white TV.

QUICK REFERENCE DATA	
Face diagonal	44 cm
Deflection angle	110°
Overall length	284,5 mm
Neck diameter	28,6 mm
Heating	6,3 V, 300 mA
Grid no. 2 voltage	400 V
Final accelerator voltage	20 kV

SCREEN

Metal-backed phosphor

Luminescence		white
Light transmission of face glass	≈	48 %
Useful diagonal	≥	413 mm
Useful width	≥	346 mm
Useful height	≥	270 mm

HEATING

Indirect by a.c. or d.c.; series or parallel supply

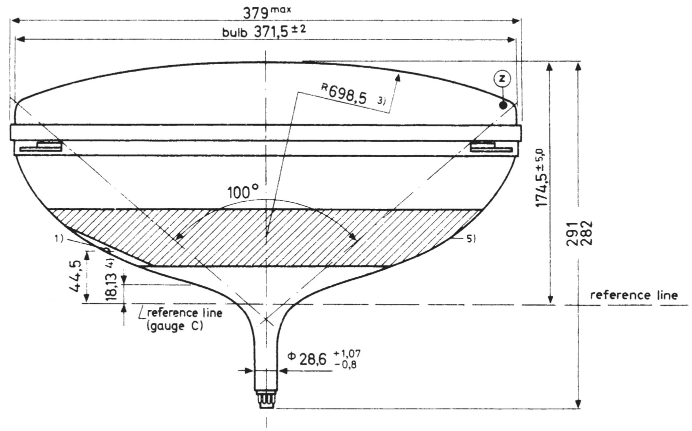
Heater current	I_f	300 mA
Heater voltage	V_f	6,3 V

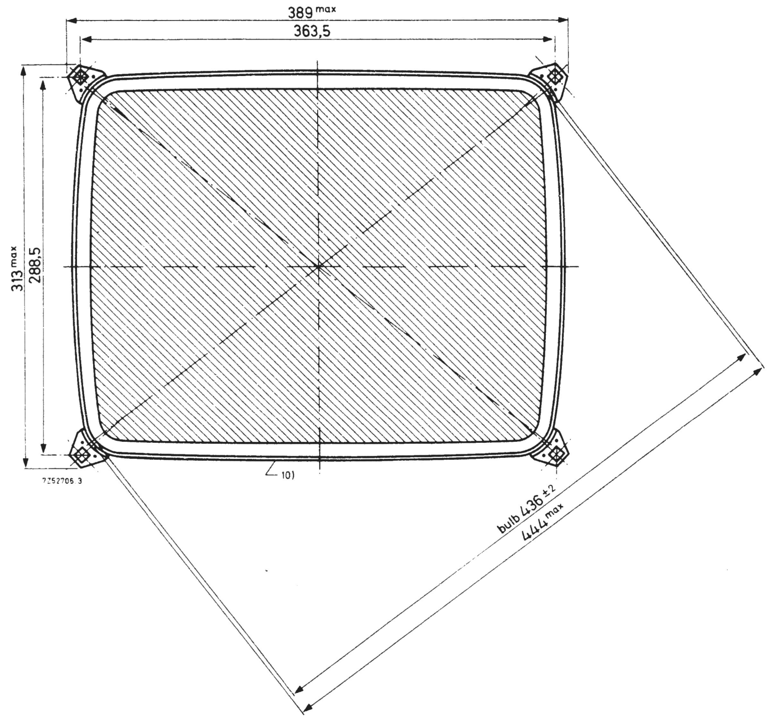
If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

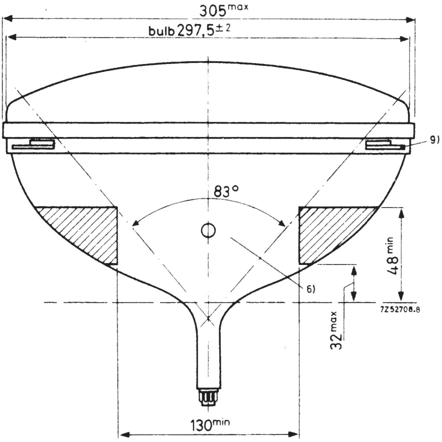
MECHANICAL DATA

Dimensions in mm

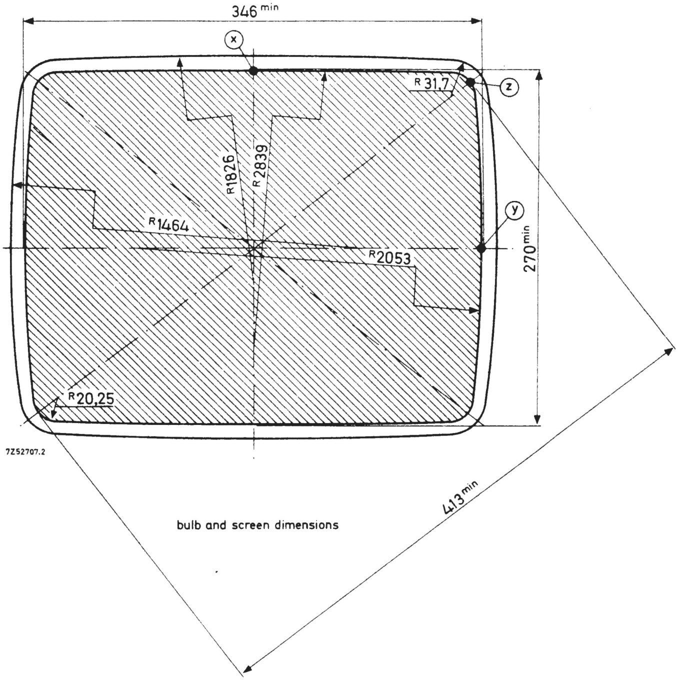
Notes are given after the drawings.


379 max
bulb 371,5 ±2
Z
R698,5 3)
100°
1)
5)
174,5 ±5,0
291
282
44,5
18,13 4)
reference line
reference line (gauge C)
Φ 28,6 +1,07 −0,8


389 max
363,5
313 max
288,5
10)
7Z52706.3
bulb 436 ±2
444 max



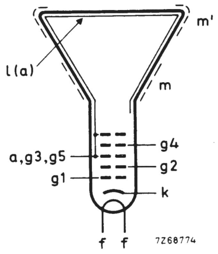
305 max
bulb 297,5 ±2
9)
83°
48 min
6)
7Z52708.8
32 max
130 min

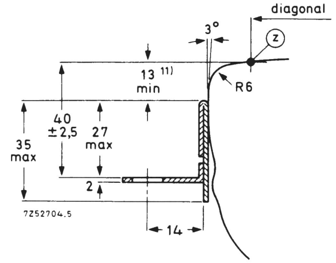


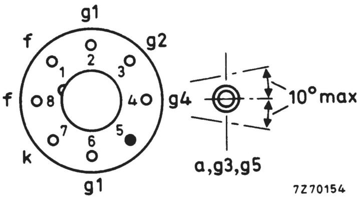
346 min
x
R 31,7
z
R1826
R2839
R1464
y
R2053
270 min
R20,25
7Z52707.2
413 min

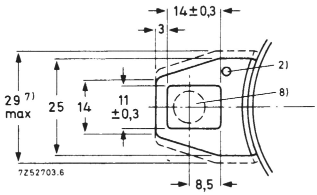
bulb and screen dimensions

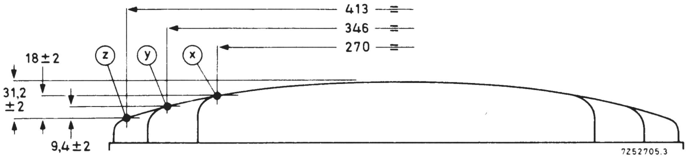
Dimensions in mm


m'
l(a)
m
g4
a,g3,g5
g2
g1
k
f
f
7Z68774


diagonal
3°
z
13 11)
min
R6
40
±2,5
27
max
35
max
2
14
7Z52704.5


g1
f
g2
1
2
3
f
8
4
g4
7
6
5
k
g1
10° max
a,g3,g5
7Z70154


14±0,3
3
2)
8)
29 7)
max
25
14
11
±0,3
8,5
7Z52703.6


413
346
270
18±2
z
y
x
31,2
±2
9,4±2
7Z52705.3

Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC-67-I-31a

Net mass : approx. 6 kg

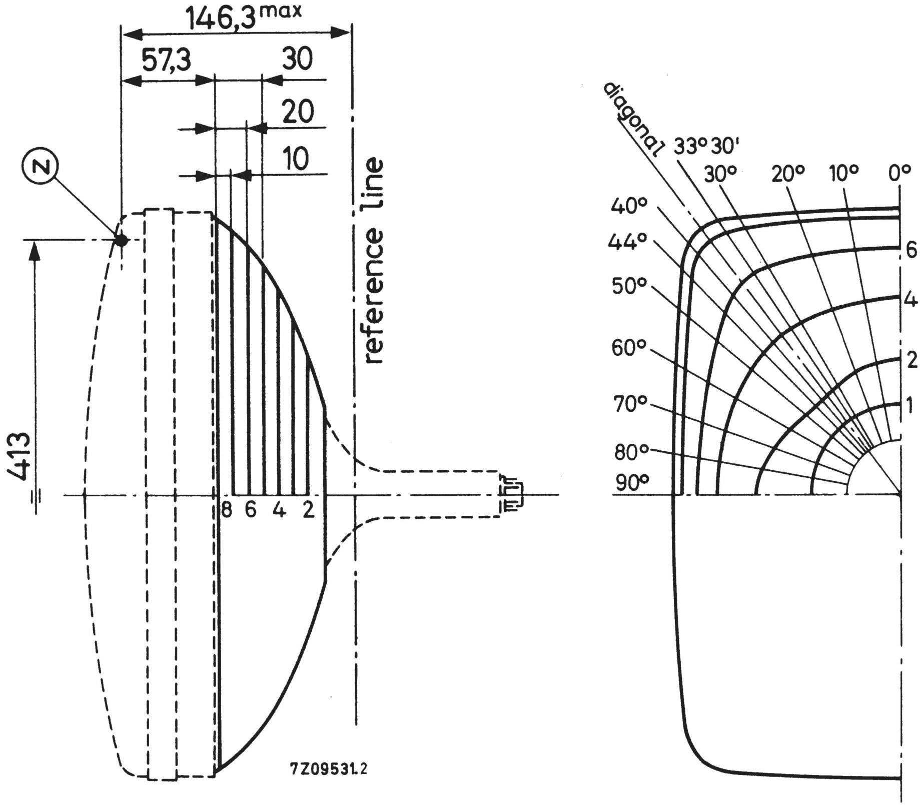
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC-67-III-2.
2. The metal rim-band must be earthed. The hole of 3 mm dia in each lug is provided for this purpose.
3. Spherical face-plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 7,5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 363,5 mm x 288,5 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm


146,3 max
57,3
30
20
10
Z
413
reference line
8 6 4 2
7Z09531.2
diagonal
33°30'
30°
20°
10°
0°
40°
44°
50°
60°
70°
80°
90°
6
4
2
1

		Distance from centre (max. values)											
Section	Nom. distance from point "Z"	0° Long	10°	20°	30°	33°30'	36°30' Diagonal	40°	44°	50°	60°	70°	80°	90° Short
1	128, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0	60, 0
2	117, 3	95, 9	95, 2	93, 0	92, 3	92, 1	92, 1	92, 3	92, 6	93, 1	93, 8	94, 6	94, 9	95, 1
3	107, 3	118, 1	117, 8	118, 3	118, 3	118, 6	119, 2	117, 8	117, 7	117, 2	115, 5	113, 3	111, 2	109, 8
4	97, 3	135, 0	136, 1	138, 3	139, 9	141, 0	141, 6	141, 1	138, 5	135, 4	130, 5	125, 6	121, 8	120, 8
5	87, 3	149, 5	151, 1	155, 1	159, 1	161, 3	162, 0	161, 5	157, 5	151, 0	142, 0	135, 8	130, 8	129, 5
6	77, 3	162, 5	164, 0	168, 8	176, 0	179, 0	179, 5	178, 0	173, 5	163, 4	150, 8	143, 3	138, 3	136, 4
7	67, 3	172, 5	174, 4	180, 1	190, 0	194, 1	196, 3	194, 9	186, 8	174, 5	159, 1	149, 3	143, 9	141, 7
8	57, 3	179, 7	183, 1	189, 3	201, 1	207, 4	210, 9	206, 1	196, 0	182, 8	165, 5	154, 0	147, 9	145, 6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	$<$ $>$	1300 700	pF pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$		200	pF
Cathode to all	C_k		5	pF
Grid no. 1 to all	C_{g1}		7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	100°
Vertical deflection angle	83°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).

Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Grid drive service

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V [1]
Grid no. 2 voltage	V_{g2}	400	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	−40 to −77	V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V [1]
Grid no. 2 voltage	V_{g2}	400	V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66	V

---

[1] Individual tubes will have optimum focus within this range. In general an acceptable picture will be obtained with a fixed focus voltage.

LIMITING VALUES (Design max. rating system)

→ Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	23 14	kV*) kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max. min.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	$V_{g2/g1}$	max.	850	V
Grid no. 1 voltage				
positive	V_{g1}	max.	0	V
positive peak	V_{g1p}	max.	2	V
negative	$-V_{g1}$	max.	200	V
negative peak	$-V_{g1p}$	max.	400	V**)
Cathode to heater voltage,				
positive	$V_{k/f}$	max.	250	V
positive peak	$V_{k/fp}$	max.	300	V
negative	$-V_{k/f}$	max.	200	V
positive during equipment warm-up period not exceeding 15 s	$V_{k/f}$	max.	450	V****)

---

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.

***) At $V_{g1/k} = 0$ V.

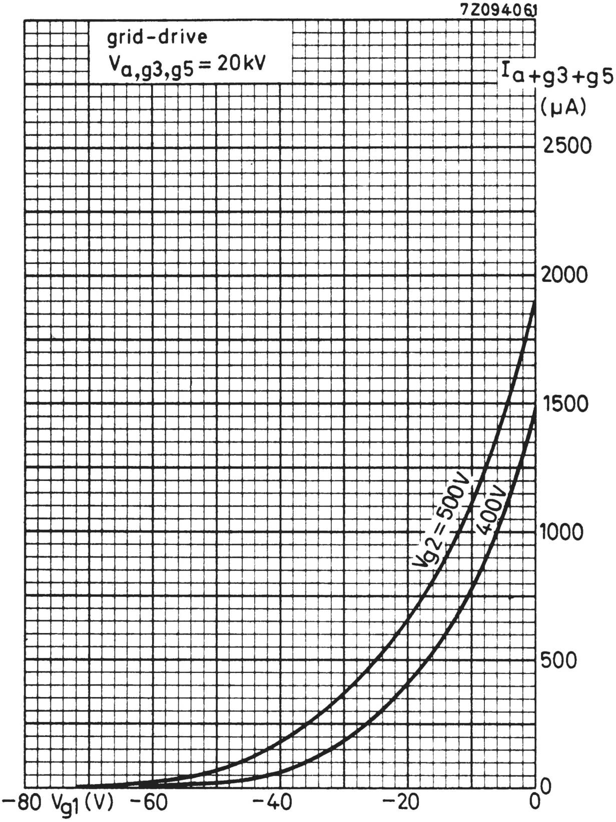
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

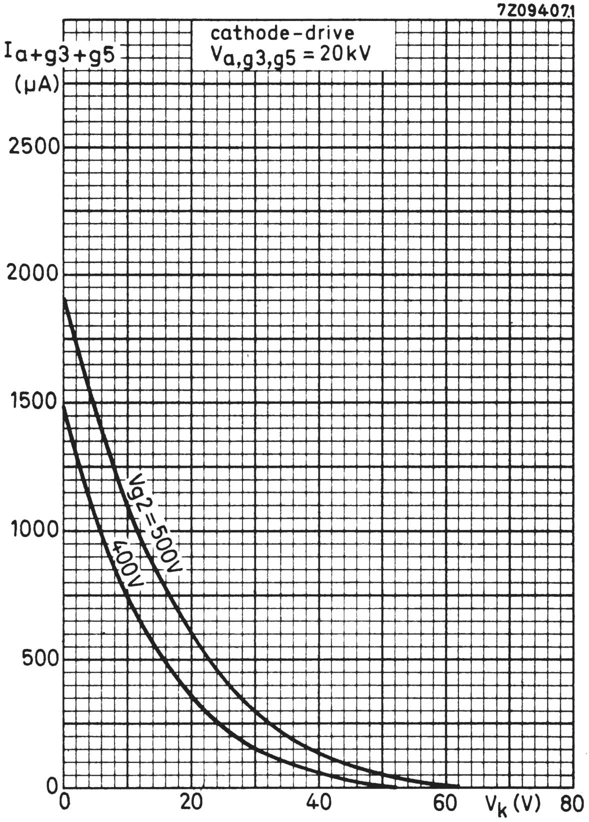
Grid no. 4 current,				
positive	I_{g4}	<	25	μA
negative	$-I_{g4}$	<	25	μA
Grid no. 2 current,				
positive	I_{g2}	<	5	μA
negative	$-I_{g2}$	<	5	μA

MAXIMUM CIRCUIT VALUES

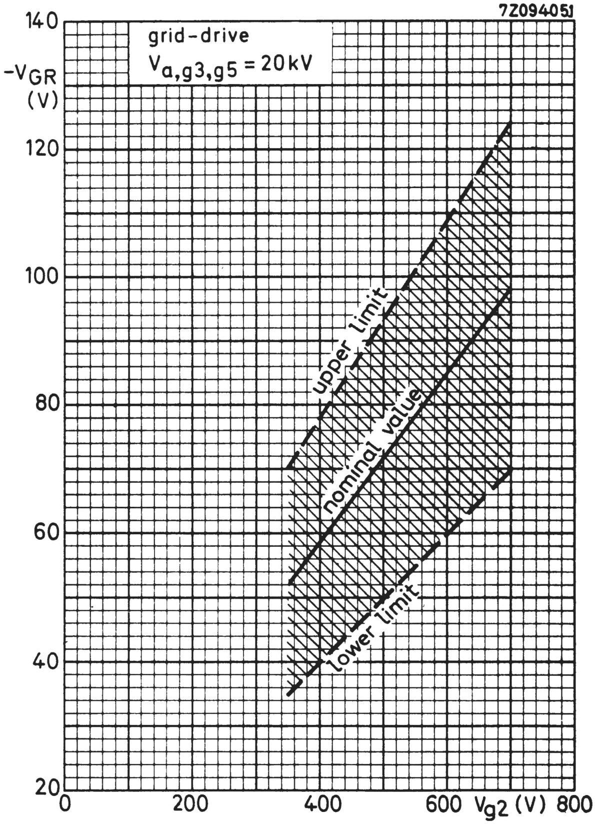
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ



Final accelerator current as a function of grid no. 1 voltage

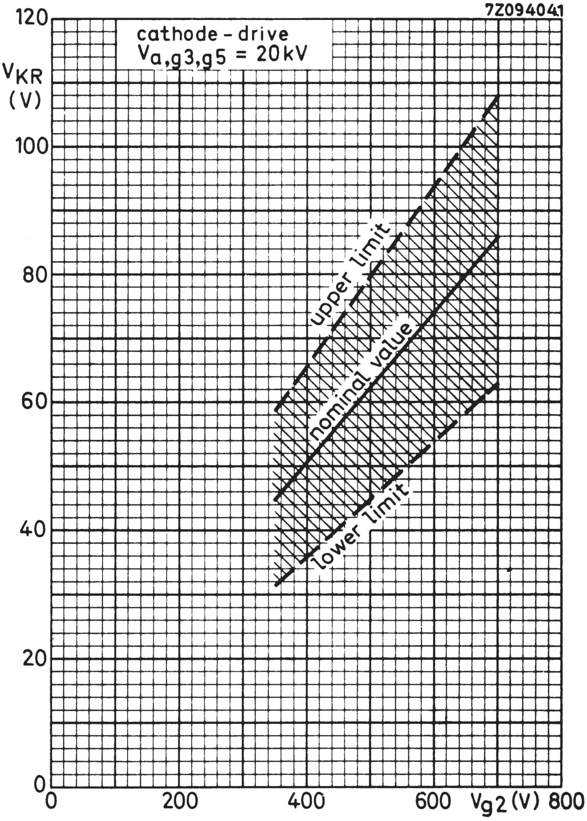


Final accelerator current as a function of cathode voltage



$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

Limits of grid No. 1 cut-off voltage as a function of grid no. 2 voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage

TV PICTURE TUBE

44 cm (17 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.
The tube is designed for "push through" application and is provided with four metal lugs for mounting into a cabinet.

QUICK REFERENCE DATA			
Face diagonal		44	cm (17 in)
Deflection angle		110°	
Overall length	max.	288	mm
Neck diameter		20	mm
Heating		11 V, 140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		12 to 15	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminescence	white		
Light transmission of face glass	≈	48	%
Useful diagonal	≥	413	mm
Useful width	≥	346	mm
Useful height	≥	270	mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		11	V
Heater current	I_f		140	mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max.	12,7	V *)
		min.	9,3	V

For heating time as a function of source impedance see last page of this data sheet.

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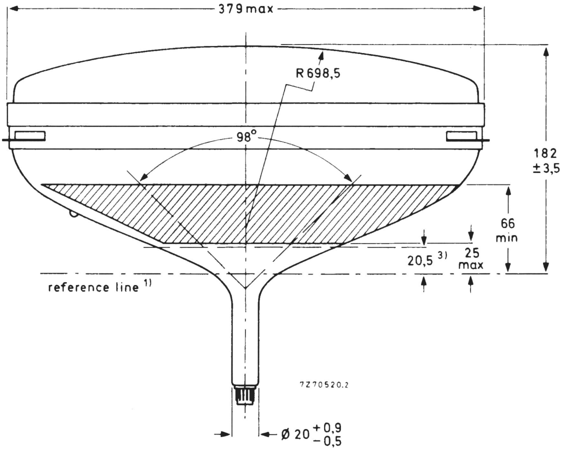
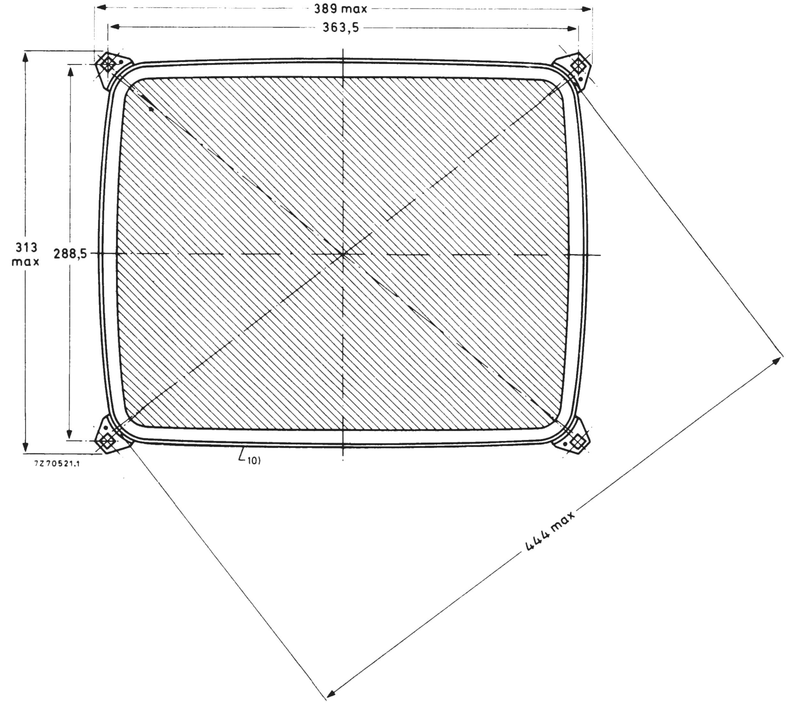
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

MECHANICAL DATA

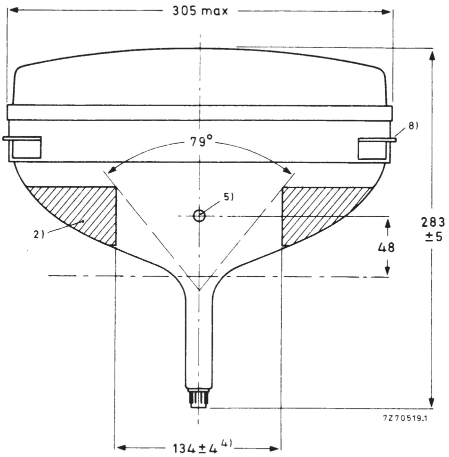
Notes are given after the drawings.

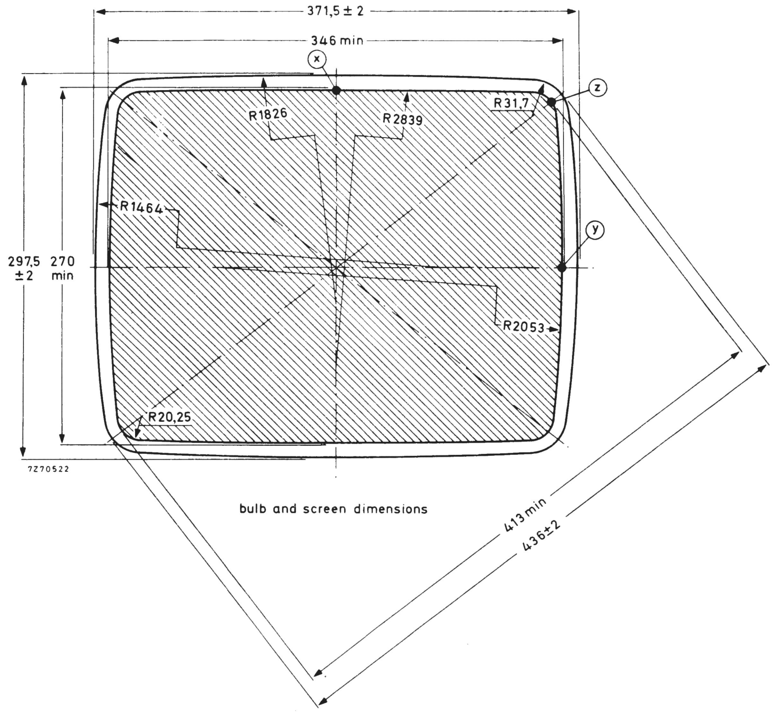


379 max
R 698,5
98°
182
±3,5
66
min
20,5 3)
25
max
reference line 1)
7Z70520.2
Ø 20 +0,9 −0,5

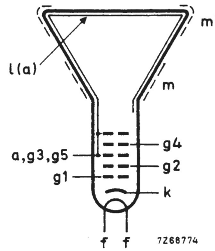


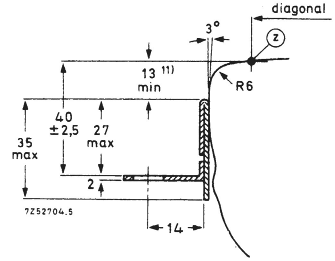
389 max
363,5
313
max
288,5
10)
7Z70521.1
444 max

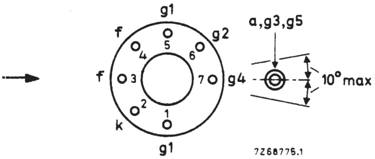

305 max
8)
79°
5)
2)
283
±5
48
7Z70519.1
134 ± 4 4)

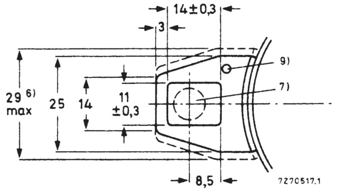

371,5 ± 2
346 min
x
z
y
R1826
R2839
R31,7
R1464
R2053
R20,25
297,5
±2
270
min
7Z70522
413 min
436±2

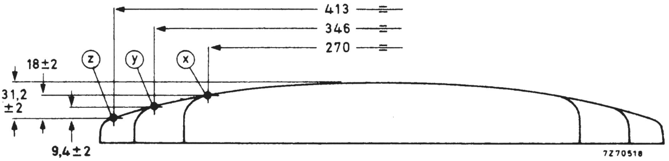
bulb and screen dimensions


m'
l(a)
m
a,g3,g5
g4
g2
g1
k
f f
7Z68774


diagonal
3°
z
13 11)
min
R6
40
±2,5
27
max
35
max
2
14
7Z52704.5


g1
f
g2
a,g3,g5
5
4
6
f
3
7
g4
10° max
2
1
k
g1
7Z68775.1


14±0,3
3
9)
7)
29 6)
max
25
14
11
±0,3
8,5
7Z70517.1


413
346
270
18±2
z
y
x
31,2
±2
9,4±2
7Z70518

Mounting position: any

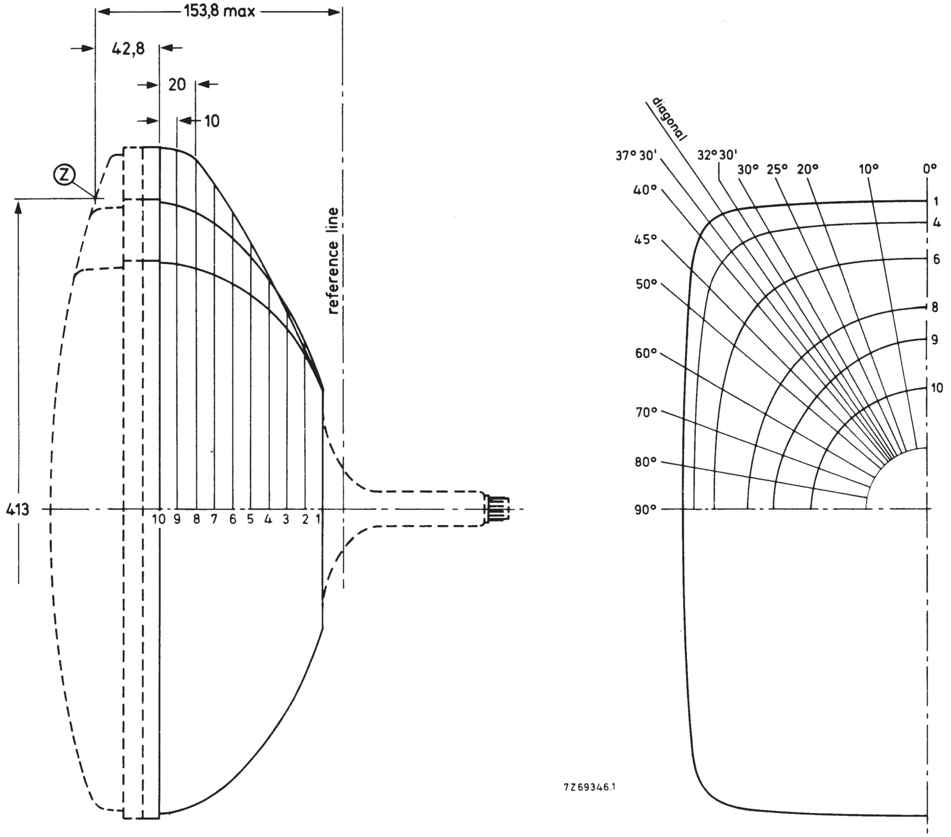
Net mass : approx. 6 kg

Base : JEDEC E7-91

The socket for the base should not be mounted rigidly, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWING

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC67-III 2.
6. Minimum space to be reserved for mounting lug.
7. The mounting screws in the cabinet must be situated inside a circle of 7,5 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 363,5 mm x 288,5 mm.
8. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
9. The metal rim-band must be earthed. The hole of 3 mm dia in each lug is provided for this purpose. Electrical contact between the metal band and mounting lugs is guaranteed.
10. Max. curvatures of the outside rim-band are: nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.


153,8 max
42,8
20
10
Z
413
reference line
10 9 8 7 6 5 4 3 2 1
diagonal
37° 30'
32° 30'
30°
25°
20°
10°
0°
40°
45°
50°
60°
70°
80°
90°
1
4
6
8
9
10
7Z69346.1

A44-510W

Section	Nom. distance from section 1	Distance from centre (max values)														
		0°	10°	20°	25°	30°	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
10	90	73, 8	73, 6	73, 1	72, 9	72, 6	72, 5	72, 3	72, 2	72, 1	71, 9	71, 8	71, 7	71, 7	71, 8	71, 9
9	80	104, 7	103, 9	102, 1	101, 0	99, 9	99, 4	98, 6	98, 4	98, 0	97, 2	96, 5	95, 6	95, 2	95, 2	95, 3
8	70	123, 9	124, 0	123, 8	123, 5	123, 0	122, 6	122, 0	121, 8	121, 2	120, 1	118, 7	116, 0	113, 5	111, 7	111, 1
7	60	140, 4	141, 3	143, 3	144, 1	144, 5	144, 5	144, 0	143, 8	143, 2	141, 2	138, 6	132, 7	127, 3	123, 8	122, 5
6	50	154, 8	156, 3	160, 3	162, 5	164, 3	164, 9	164, 7	164, 5	163, 7	160, 5	156, 0	146, 1	138, 1	133, 2	131, 5
5	40	166, 9	168, 9	174, 5	178, 1	181, 6	183, 1	183, 4	183, 2	182, 1	177, 2	170, 2	156, 6	146, 6	140, 8	138, 9
4	30	176, 8	179, 1	185, 9	190, 9	196, 3	198, 9	200, 0	199, 8	198, 4	191, 2	181, 2	164, 4	153, 0	146, 7	144, 6
3	20	184, 1	186, 6	194, 4	200, 4	208, 0	212, 0	214, 6	214, 3	212, 6	202, 0	189, 0	169, 6	157, 4	150, 8	148, 6
2	10	188, 6	191, 2	199, 3	205, 6	213, 9	218, 4	221, 3	221, 2	219, 2	207, 2	193, 1	172, 9	160, 4	153, 6	151, 4
1	0	190, 0	192, 6	200, 7	207, 1	215, 3	219, 9	222, 7	222, 5	220, 5	208, 6	194, 4	174, 1	161, 5	154, 7	152, 5

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	< 1300 > 700	pF pF
Final accelerator to metal rimband	$C_{a,g3,g5/m'}$	200	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	98°
Vertical deflection angle	79°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of filed of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	12 to 15	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

---

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 V and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	17 9	kV*) kV
Grid no. 4 voltage				
Positive	V_{g4}	max.	500	V
Negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	$V_{g2/k}$	max.	200	V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

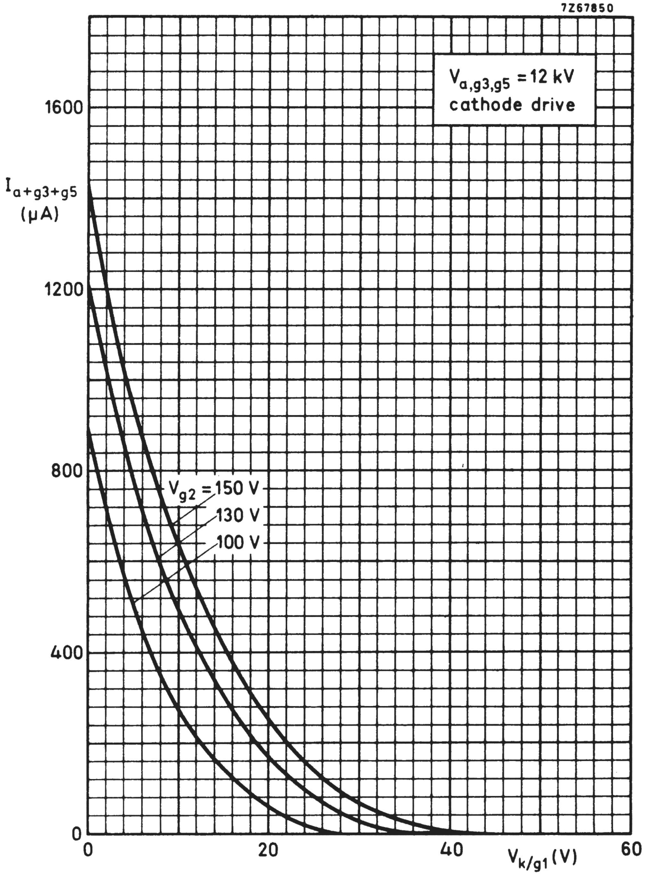
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid no. 1 impedance	Z_{g1}(50 Hz)	max.	0, 5	MΩ

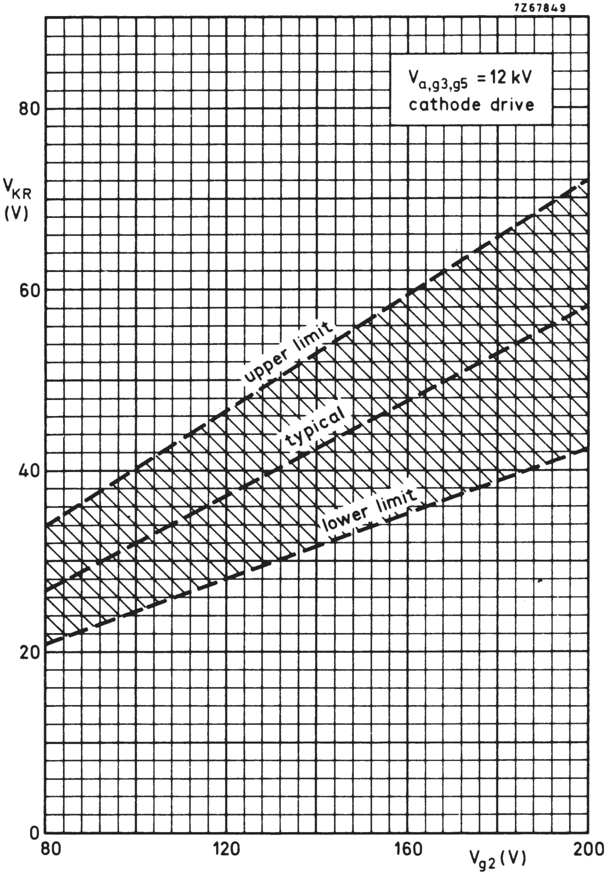
---

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1, 5 ms.

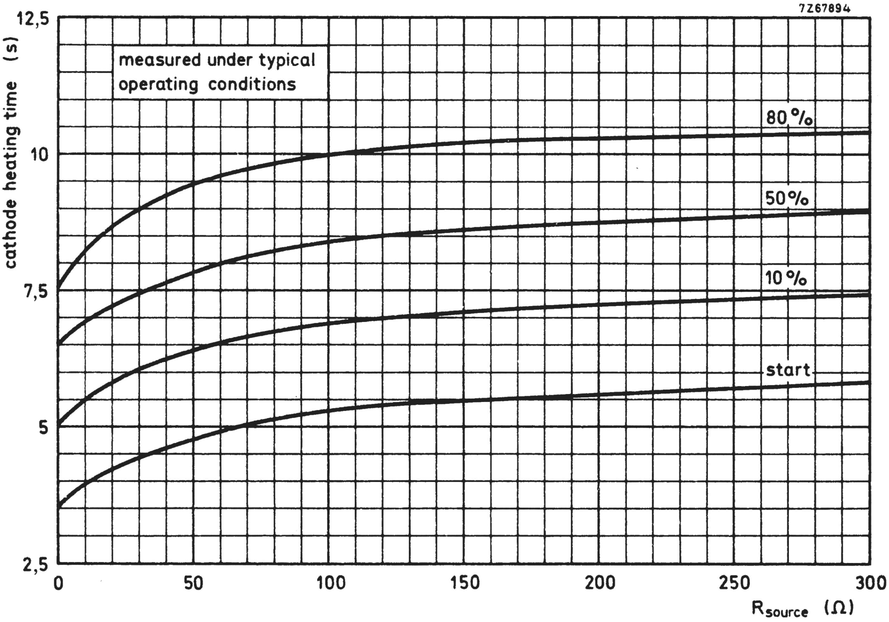


Final accelerator current as a function of cathode voltage.



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

44 cm (17 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal		44 cm
Deflection angle		110°
Overall length	max.	291 mm
Neck diameter		28, 6 mm
Heating		6, 3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.	

SCREEN

Metal-backed phosphor		
Luminescence	white	
Light transmission of face glass	≈	48 %
Useful diagonal	≥	413 mm
Useful width	≥	346 mm
Useful height	≥	270 mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		6, 3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7, 3 V *) 5, 3 V

For heating time as a function of source impedance see last page of this data sheet.

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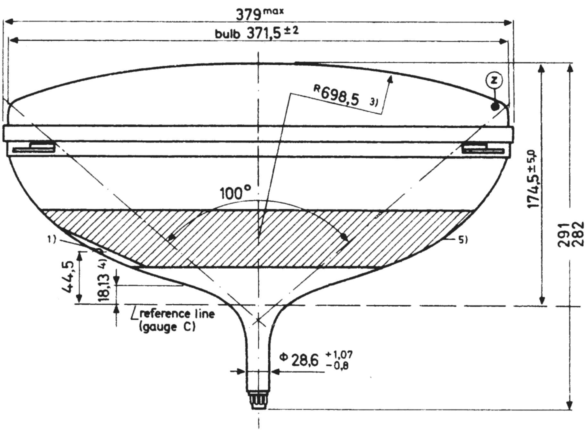
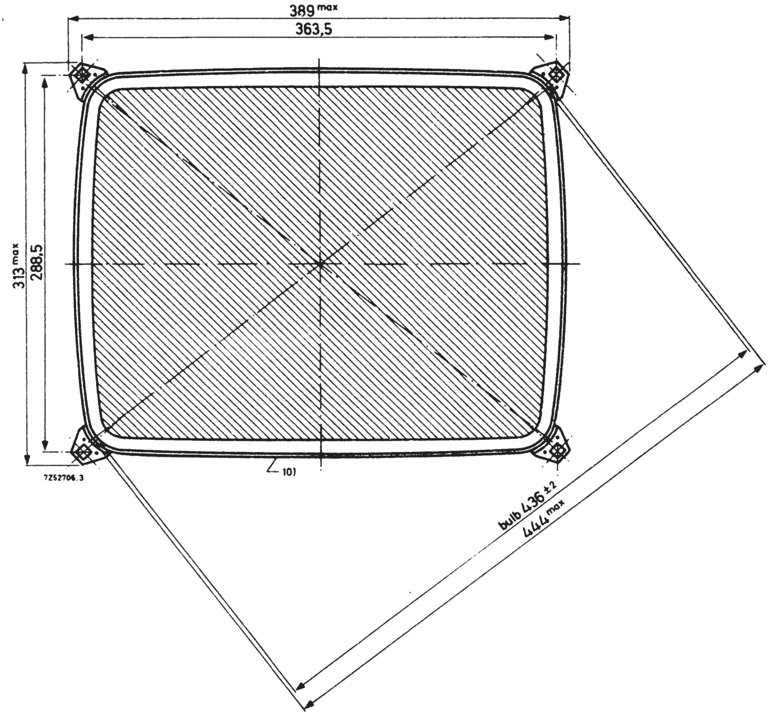
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

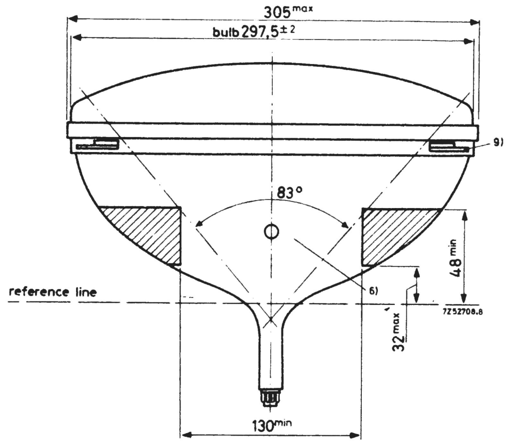
MECHANICAL DATA

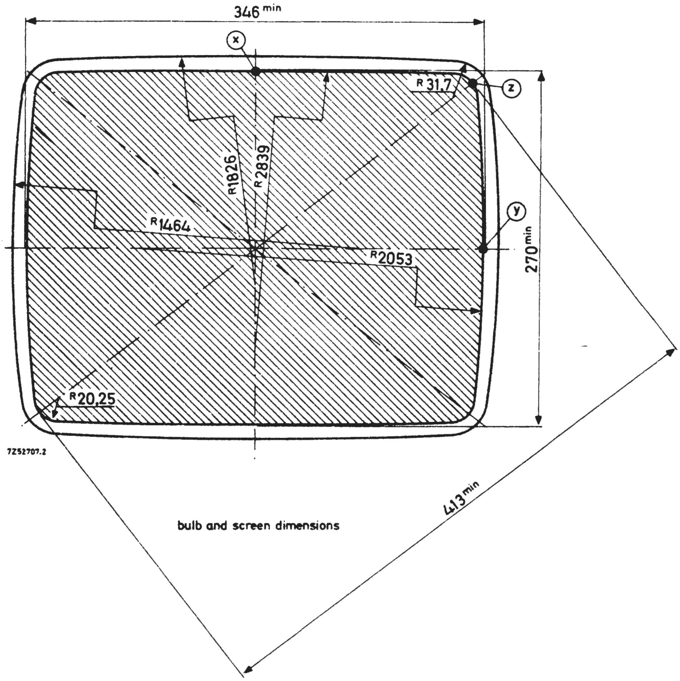
Dimensions in mm

Notes are given after the drawings.

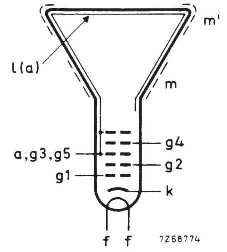

379 max
bulb 371,5 ±2
R698,5 3)
z
100°
1)
5)
44,5
18,13 4)
reference line
(gauge C)
Φ 28,6 +1,07 −0,8
174,5 ±5,0
291
282

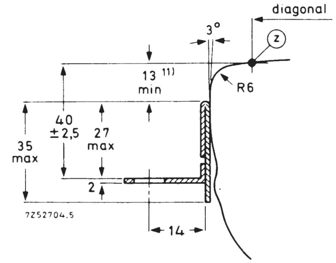

389 max
363,5
313 max
288,5
10)
7Z52706.3
bulb 436 ±2
444 max

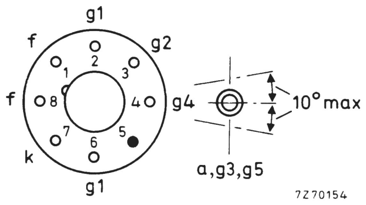

305 max
bulb 297,5 ±2
9)
83°
48 min
6)
reference line
32 max
7Z52708.8
130 min

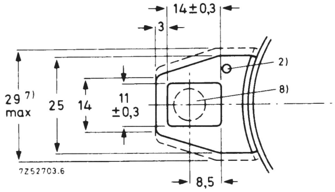

346 min
x
z
y
R 31,7
R1826
R2839
R1464
R2053
270 min
R20,25
7Z52707.2
413 min

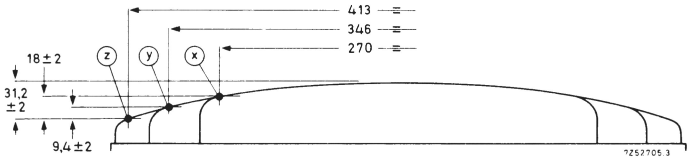
bulb and screen dimensions


m'
l(a)
m
g4
a,g3,g5
g2
g1
k
f f
7Z68774


diagonal
3°
z
13 11)
min
R6
40
±2,5
27
max
35
max
2
14
7Z52704.5


g1
f
g2
1
2
3
f
8
4
g4
7
6
5
k
g1
10° max
a,g3,g5
7Z70154


14±0,3
3
2)
8)
29 7)
max
25
14
11
±0,3
8,5
7Z52703.6


413
346
270
z
y
x
18±2
31,2
±2
9,4±2
7Z52705.3

Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC 67-I-31a

Net mass : approx. 6 kg

The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.

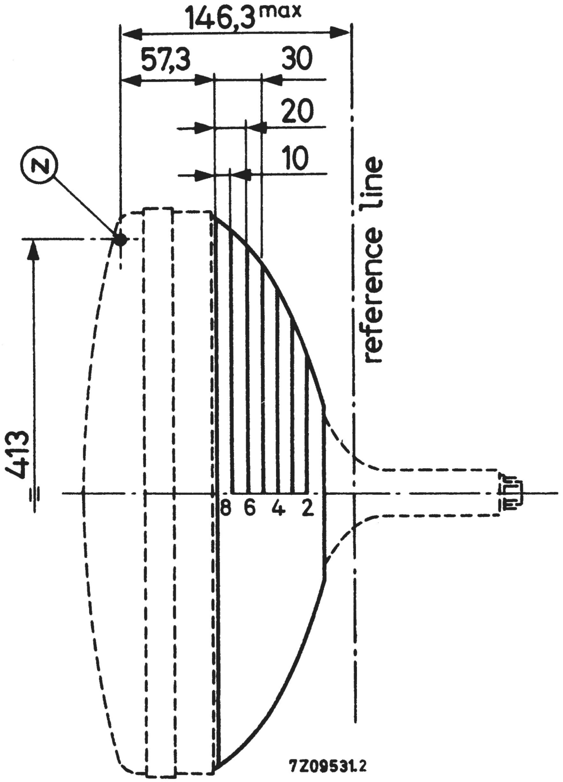
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

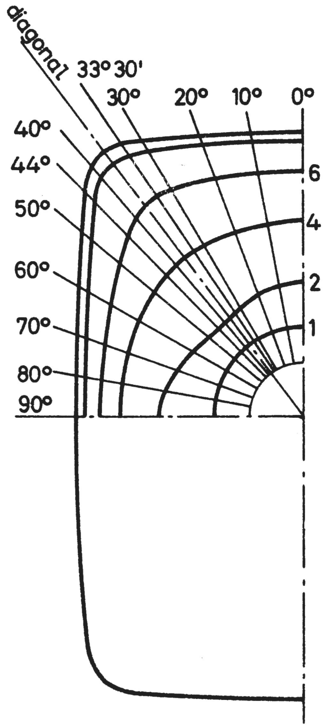
NOTES TO OUTLINE DRAWING

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The hole of 3 mm dia in each lug is provided for this purpose.
3. Spherical face-plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 7, 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 363, 5 mm x 288, 5 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm


146,3 max
57,3
30
20
10
Z
reference line
413
8 6 4 2
7Z09531.2


diagonal
33° 30'
30°
20°
10°
0°
40°
44°
50°
60°
70°
80°
90°
6
4
2
1

Sec-tion	Nom. distance from point "Z"	Distance from centre (max. values)												
		0° Long	10°	20°	30°	33°30'	36°30' Diagonal	40°	44°	50°	60°	70°	80°	90° Short
1	128,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0
2	117,3	95,9	95,2	93,0	92,3	92,1	92,1	92,3	92,6	93,1	93,8	94,6	94,9	95,1
3	107,3	118,1	117,8	118,3	118,3	118,6	119,2	117,8	117,7	117,2	115,5	113,3	111,2	109,8
4	97,3	135,0	136,1	138,3	139,9	141,0	141,6	141,1	138,5	135,4	130,5	125,6	121,8	120,8
5	87,3	149,5	151,1	155,1	159,1	161,3	162,0	161,5	157,5	151,0	142,0	135,8	130,8	129,5
6	77,3	162,5	164,0	168,8	176,0	179,0	179,5	178,0	173,5	163,4	150,8	143,3	138,3	136,4
7	67,3	172,5	174,4	180,1	190,0	194,1	196,3	194,9	186,8	174,5	159,1	149,3	143,9	141,7
8	57,3	179,7	183,1	189,3	201,1	207,4	210,9	206,1	196,0	182,8	165,5	154,0	147,9	145,6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	$<$ $>$	1300 700	pF pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$		200	pF
Cathode to all	C_k		3	pF
Grid no. 1 to all	C_{g1}		7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	100°
Vertical deflection angle	83°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 130	V 1)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62	V

---

1) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

→ Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max.	23	kV*)
		min.	14	kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max.	200	V**)
		min.	80	V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current,				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current,				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

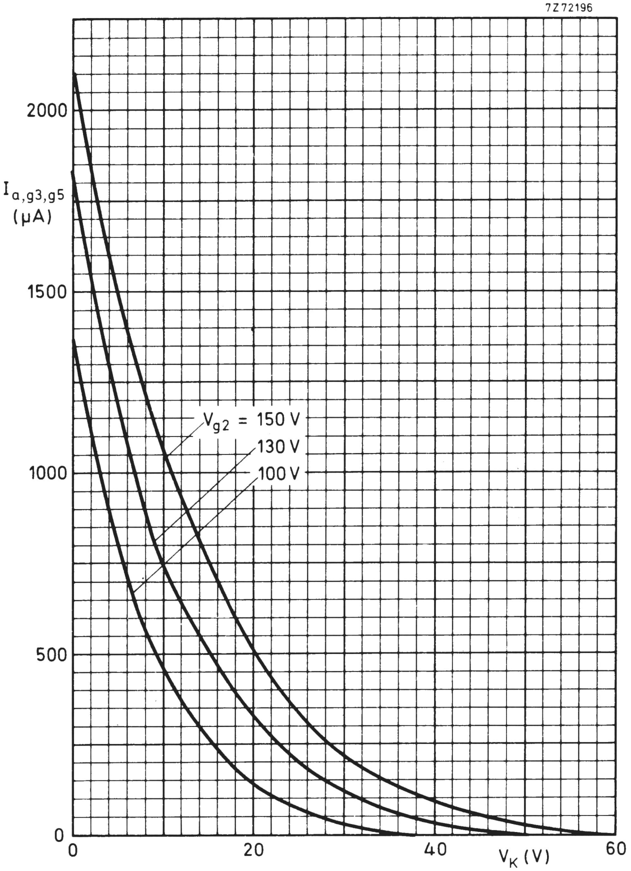
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

---

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

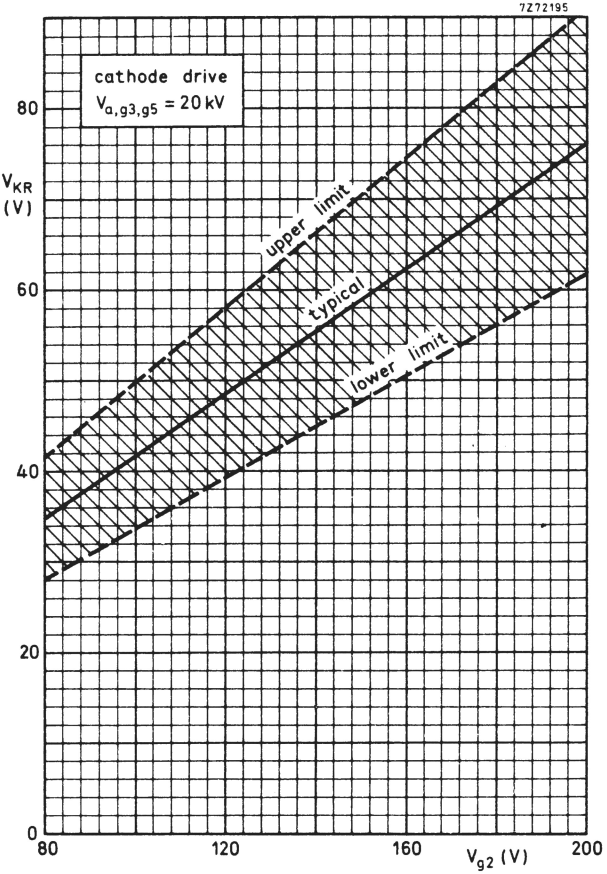
**) At $V_{k/g1} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.



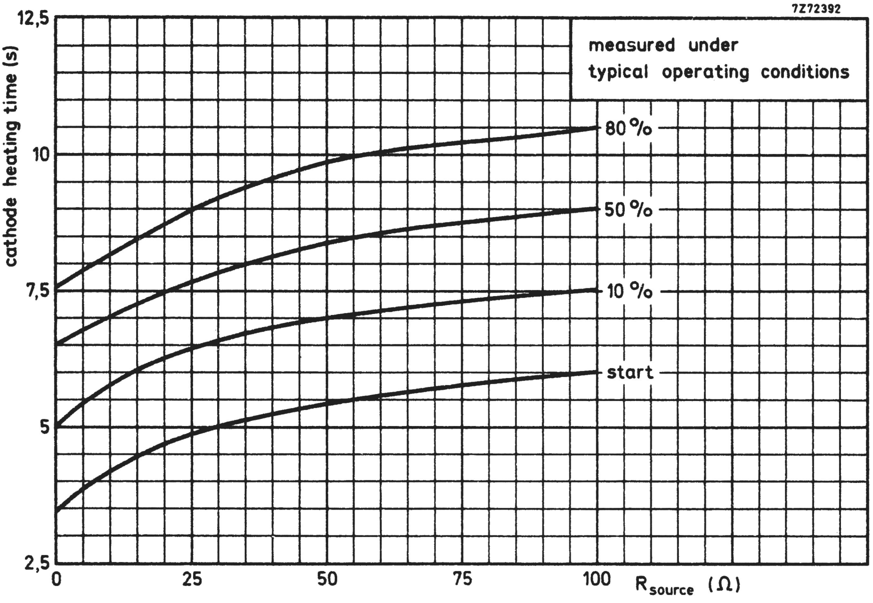
Final accelerator current as a function of cathode voltage

Cathode drive V_{a,g_3,g_5} = 20 kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

50 cm (20 in), 110°, rectangular direct vision picture tube with integral protection for black-and-white TV.

QUICK REFERENCE DATA	
Face diagonal	50 cm (20 in)
Deflection angle	110°
Overall length	312,5 mm
Neck diameter	28,6 mm
Heating	6,3 V, 300 mA
Grid no. 2 voltage	400 V
Final accelerator voltage	20 kV

SCREEN

Metal-backed phosphor

Luminescence	white		
Light transmission of face glass	≈	45	%
Useful diagonal	≥	473	mm
Useful width	≥	394	mm
Useful height	≥	308	mm

HEATING

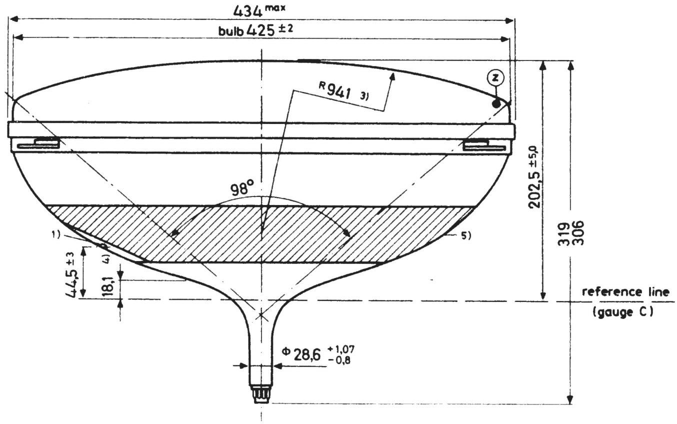
Indirect by a.c. or d.c.; series or parallel supply

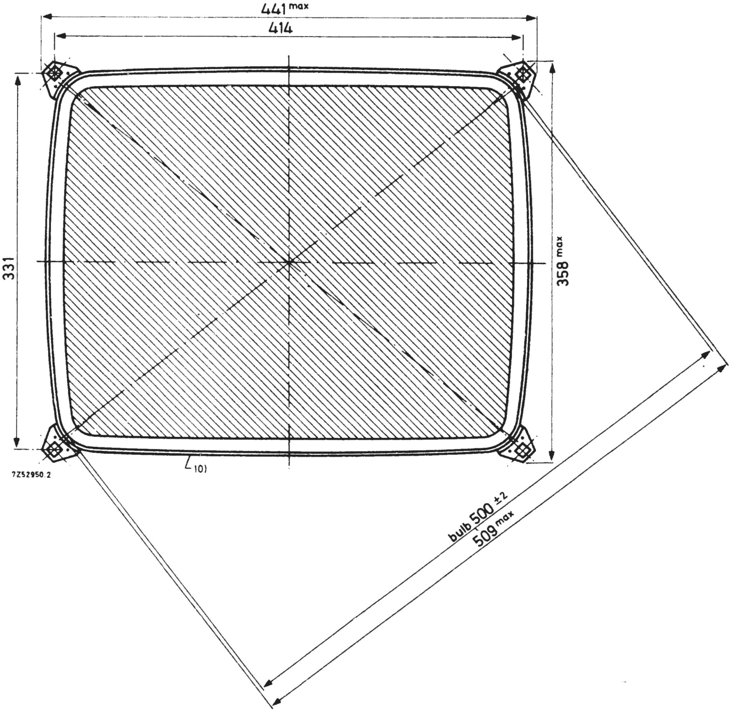
Heater current	I_f	300	mA
Heater voltage	V_f	6,3	V

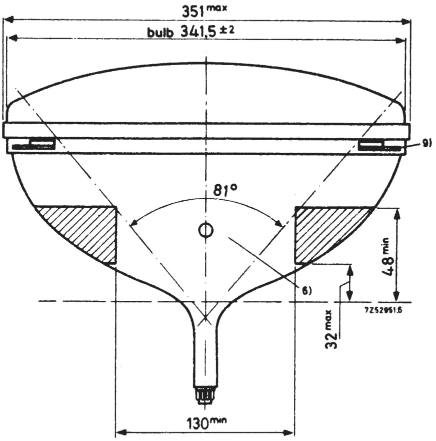
If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

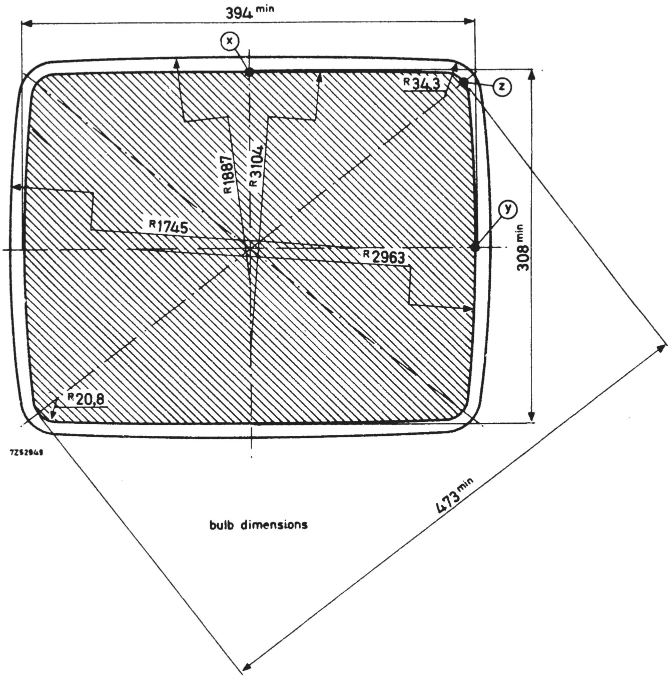
MECHANICAL DATA Dimensions in mm

Notes are given after the drawings.

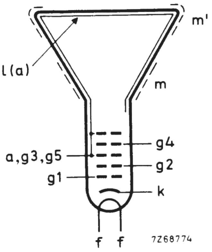

434 max
bulb 425 ±2
Z
R941 3)
98°
1)
4)
5)
44,5 ±3
18,1
202,5 ±5,0
319
306
reference line
(gauge C)
Φ 28,6 +1,07 −0,8

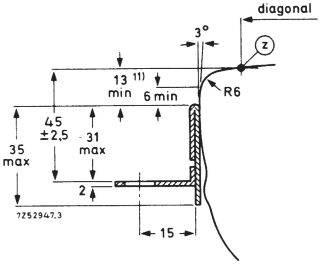

441 max
414
331
358 max
10)
bulb 500 ±2
509 max
7Z52950.2

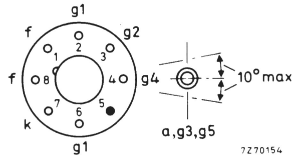

351 max
bulb 341,5 ±2
9)
81°
48 min
6)
32 max
130 min
7Z52951.6

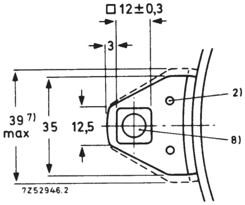

394 min
x
z
y
R34,3
R1887
R3104
R1745
R2963
R20,8
308 min
473 min
7Z52949

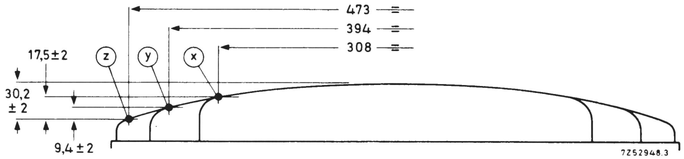
bulb dimensions


m'
l(a)
m
a,g3,g5
g4
g2
g1
k
f f
7Z68774


diagonal
3°
z
13 11)
min
6 min
R6
45
±2,5
31
max
35
max
2
15
7Z52947.3


g1
f
g2
1
2
3
f
8
4
g4
7
6
5
k
g1
10° max
a,g3,g5
7Z70154


□12±0,3
3
2)
39 7)
max
35
12,5
8)
7Z52946.2


473
394
308
17,5±2
z
y
x
30,2
± 2
9,4 ± 2
7Z52948.3

Mounting position: any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC67-1-31a

Net mass : approx. 8,5 kg

The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.

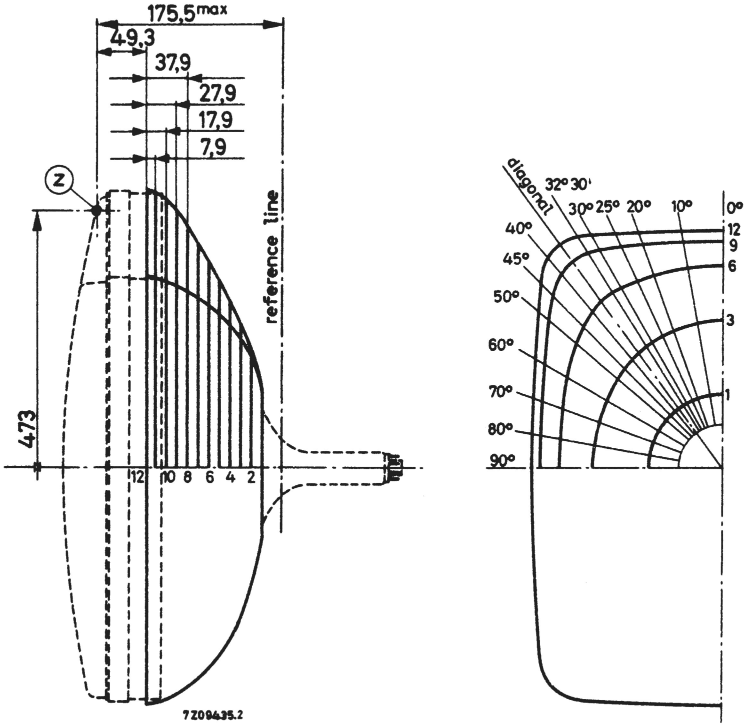
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face-plate.
4. End of guaranteed contour. The maximum neck-and-cone contour is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position i.e. at the corners of a rectangle of 414 mm x 331 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are: nominal bulb radius +4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



A50-120W A50-520W

		Distance from centre (max. values)													
Section	Nom distance from point "Z"	0° Long	10°	20°	25°	30°	32° 30'	36° 30' Diagonal	40°	45°	50°	60°	70°	80°	90° Short
1	157,2	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0
2	147,2	109,2	107,8	107,1	106,4	106,0	105,9	105,5	105,0	104,5	103,9	102,8	102,6	102,8	103,4
3	137,2	136,7	134,5	133,7	133,0	132,3	131,8	130,7	129,3	127,5	125,3	121,9	120,7	120,2	120,2
4	127,2	157,2	156,5	155,7	154,8	153,8	153,0	151,5	150,0	147,5	144,7	138,7	134,9	133,4	132,5
5	117,2	174,2	174,0	174,4	174,3	173,4	172,8	171,0	169,3	165,7	160,8	152,0	146,5	143,7	142,3
6	107,2	185,8	186,3	188,4	190,0	191,2	191,2	189,5	186,7	181,7	174,7	163,2	156,0	151,7	150,4
7	97,2	194,5	195,7	202,2	203,8	206,9	207,3	206,4	203,5	196,4	187,4	173,0	163,5	158,6	156,9
8	87,2	201,7	203,8	210,2	215,4	220,6	222,1	222,2	218,8	210,5	198,8	181,2	170,3	164,7	162,7
9	77,2	208,2	210,6	218,5	224,8	231,4	234,8	236,5	233,5	222,2	208,5	188,5	176,6	169,9	167,9
10	67,2	213,1	215,9	225,2	231,9	239,8	244,3	248,5	244,8	230,3	216,0	194,7	181,6	174,5	172,0
11	57,2	215,6	219,0	228,2	235,4	244,5	249,6	253,7	250,2	235,7	220,5	198,6	184,8	177,2	174,7
12	49,3	217,0	219,8	229,3	236,6	246,0	251,2	254,5	251,7	237,2	222,0	199,6	185,6	177,8	175,7

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	< 1500 > 1000	pF pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	250	pF
Cathode to all	C_k	5	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal	110°
Horizontal deflection angle	98°
Vertical deflection angle	81°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).

Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Grid drive service

Final accelerator voltage	$V_{a, g3, g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V *)
Grid no. 2 voltage	V_{g2}	400	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	−40 to −77	V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a, g3, g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V *)
Grid no. 2 voltage	V_{g2}	400	V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66	V

---

*) Individual tubes will have optimum focus within this range. In general an acceptable picture will be obtained with a fixed focus voltage.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,\,g3,\,g5} = 0$	$V_{a,\,g3,\,g5}$	max. min.	23 14	kV*) kV
Grid no. 4 voltage				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max. min.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	$V_{g2/g1}$	max.	850	V
Grid no. 1 voltage,				
positive	V_{g1}	max.	0	V
positive peak	V_{g1p}	max.	2	V
negative	$-V_{g1}$	max.	200	V
negative peak	$-V_{g1p}$	max.	400	V**)
Cathode-to-heater voltage,				
positive	$V_{k/f}$	max.	250	V
positive peak	$V_{k/fp}$	max.	300	V
negative	$-V_{k/f}$	max.	200	V
positive during equipment warm-up period not exceeding 15 s	$V_{k/f}$	max.	450	V****)

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*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.

***) At $V_{g1/k} = 0$ V.

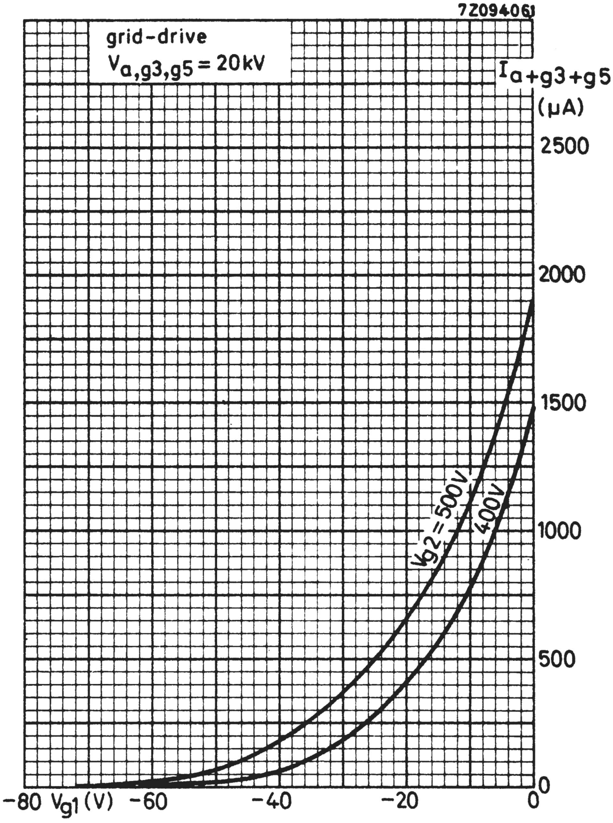
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

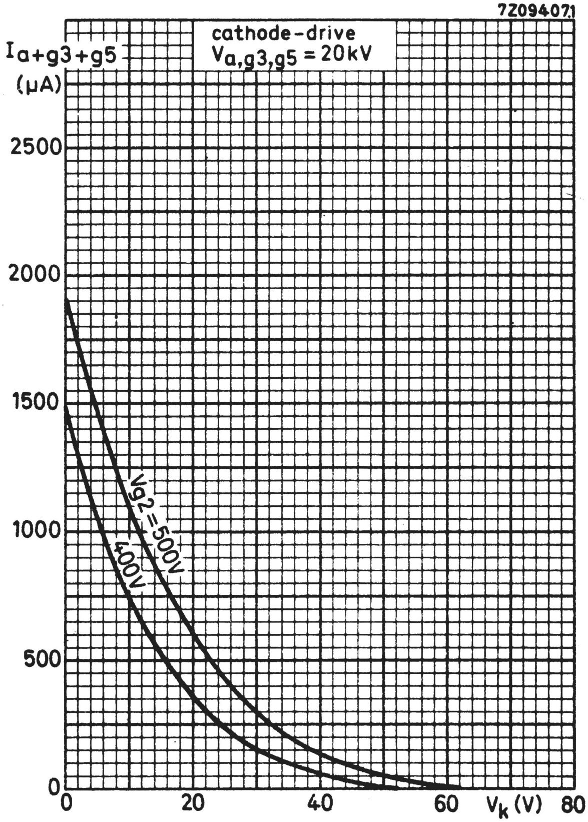
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

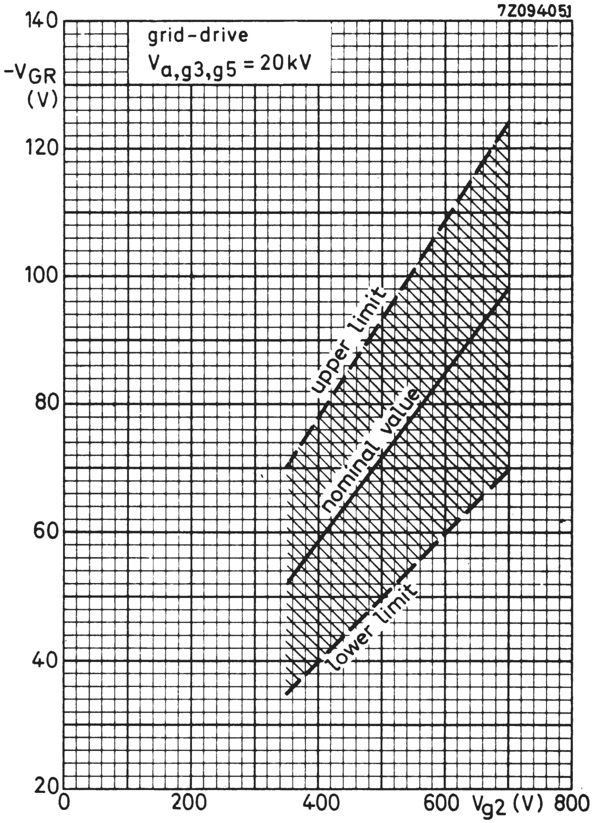
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ



Final accelerator current as a function of grid no. 1 voltage

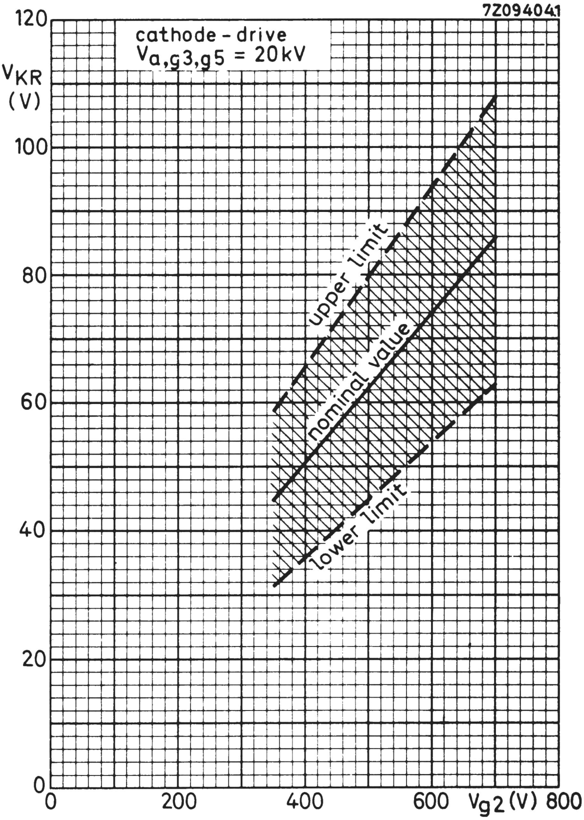


Final accelerator current as a function of cathode voltage



$$\frac{\Delta V_{GR}}{\Delta V_{a,\,g3,\,g5}} = 0,15 \times 10^{-3}$$

Limits of grid no. 1 cut-off voltage as a function of grid no. 2 voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,15 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage

TV PICTURE TUBE

50 cm (20 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA		
Face diagonal		50 cm
Deflection angle		110°
Overall length	max.	319 mm
Neck diameter		28, 6 mm
Heating		6, 3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.	

SCREEN

Metal-backed phosphor

Luminescence	white	
Light transmission of face glass	≈	45 %
Useful diagonal	≥	473 mm
Useful width	≥	394 mm
Useful height	≥	308 mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		6, 3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7, 3 V *) 5, 3 V

For heating time as a function of source impedance see last page of this data sheet.

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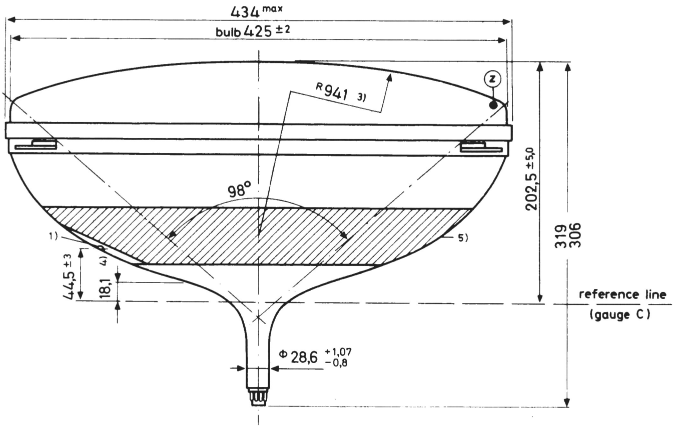
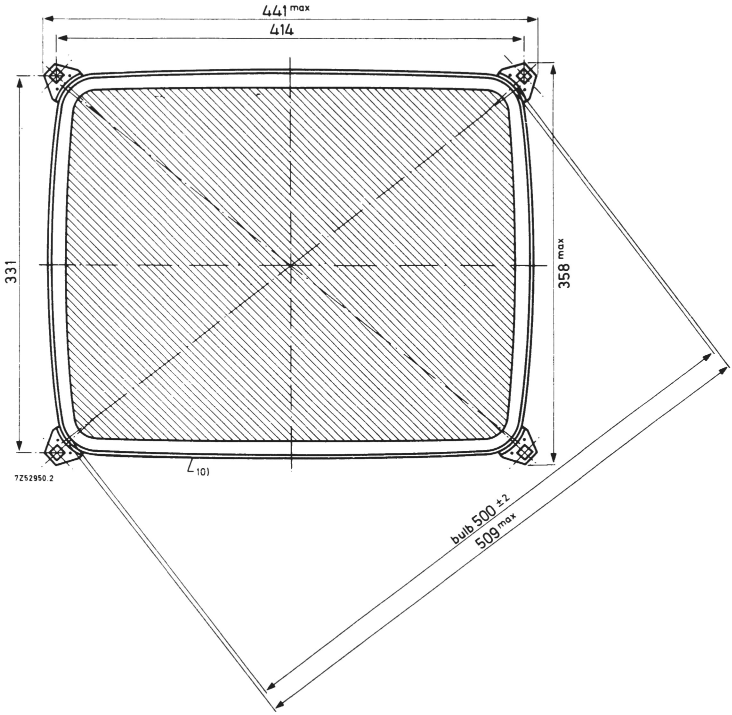
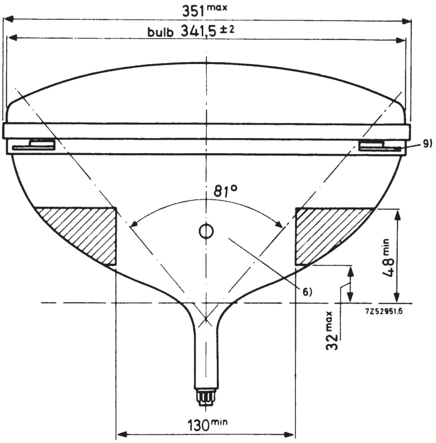
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain it not allowed.

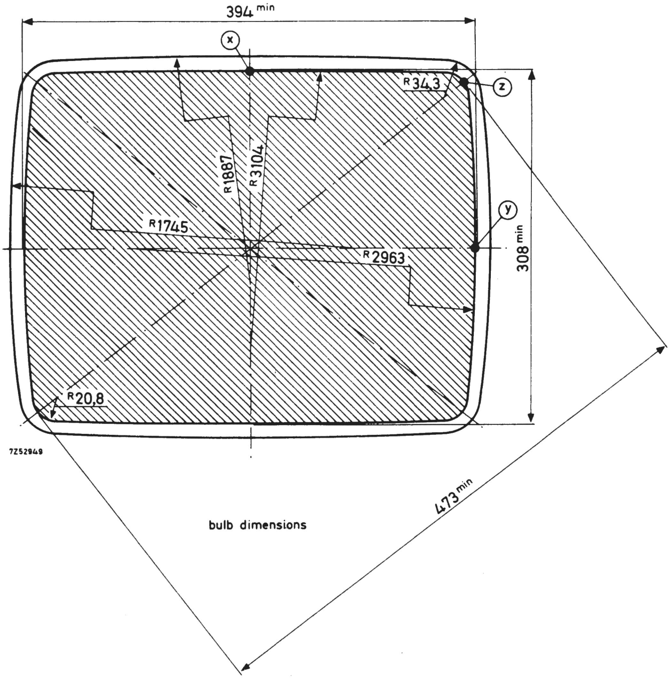
MECHANICAL DATA Dimensions in mm

Notes are given after the drawings.

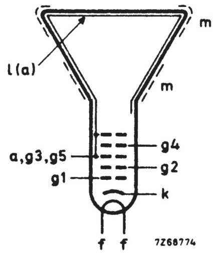

434 max
bulb 425 ±2
R941 3)
z
98°
1)
4)
5)
44,5 ±3
18,1
202,5 ±5,0
319
306
reference line
(gauge C)
Φ 28,6 +1,07 −0,8

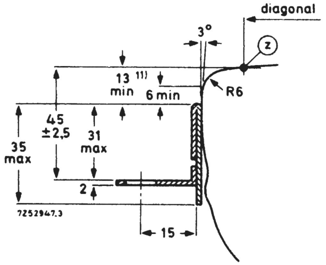

441 max
414
331
358 max
10)
7Z52950.2
bulb 500 ±2
509 max

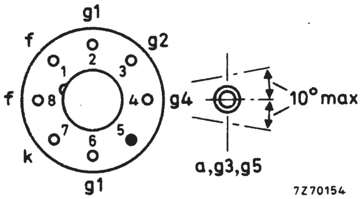

351 max
bulb 341,5 ±2
9)
81°
6)
48 min
32 max
7Z52951.6
130 min

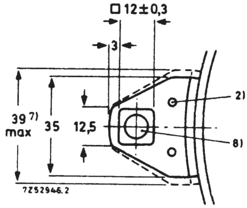

394 min
x
z
R34,3
R1887
R3104
R1745
y
R2963
308 min
R20,8
7Z52949
473 min

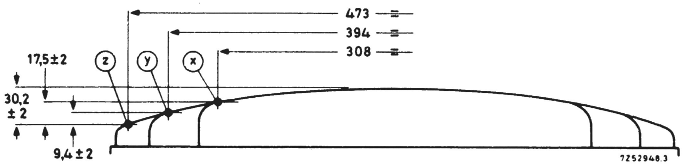
bulb dimensions


m'
l(a)
m
a,g3,g5
g4
g2
g1
k
f
f
7Z68774


diagonal
3°
z
13 11)
min
6 min
R6
45
±2,5
31
max
35
max
2
15
7Z52947.3


g1
f
g2
2
1
3
f
8
4
g4
7
5
6
k
g1
10° max
a,g3,g5
7Z70154


□ 12±0,3
3
39 7)
max
35
12,5
2)
8)
7Z52946.2


473
394
308
17,5±2
z
y
x
30,2
± 2
9,4 ± 2
7Z52948.3

Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC 67-1-31a

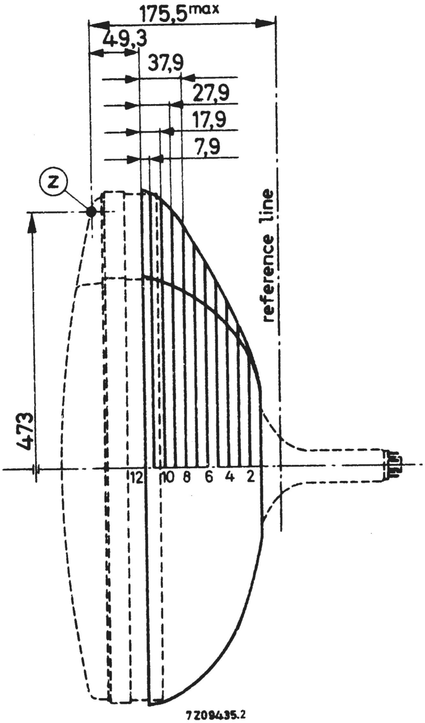
Net mass : approx. 8,5 kg

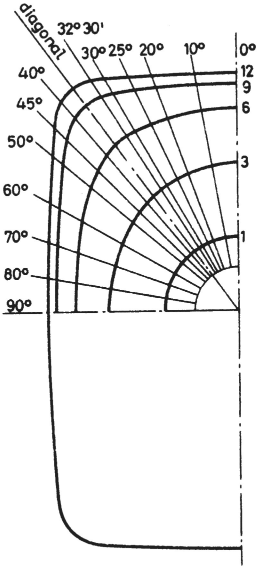
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.

NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face plate.
4. End of guaranteed contour. The maximum neck-and-cone contour is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position i.e. at the corners of a rectangle of 414 mm x 331 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are: nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING





A50-120W A50-520W

Section	Nom distance from point "Z"	Distance from centre (max. values) 0° Long	10°	20°	25°	30°	32° 30'	36° 30' Diagonal	40°	45°	50°	60°	70°	80°	90° Short
1	157,2	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0
2	147,2	109,2	107,8	107,1	106,4	106,0	105,9	105,5	105,0	104,5	103,9	102,8	102,6	102,8	103,4
3	137,2	136,7	134,5	133,7	133,0	132,3	131,8	130,7	129,3	127,5	125,3	121,9	120,7	120,2	120,2
4	127,2	157,2	156,5	155,7	154,8	153,8	153,0	151,5	150,0	147,5	144,7	138,7	134,9	133,4	132,5
5	117,2	174,2	174,0	174,4	174,3	173,4	172,8	171,0	169,3	165,7	160,8	152,0	146,5	143,7	142,3
6	107,2	185,8	186,3	188,4	190,0	191,2	191,2	189,5	186,7	181,7	174,7	163,2	156,0	151,7	150,4
7	97,2	194,5	195,7	202,2	203,8	206,9	207,3	206,4	203,5	196,4	187,4	173,0	163,5	158,6	156,9
8	87,2	201,7	203.8	210,2	215,4	220,6	222,1	222,2	218,8	210,5	198,8	181,2	170,3	164,7	162,7
9	77,2	208,2	210,6	218,5	224,8	231,4	234,8	236,5	233,5	222,2	208,5	188,5	176,6	169,9	167,9
10	67,2	213,1	215,9	225,2	231,9	239,8	244,3	248,5	244,8	230,3	216,0	194,7	181,6	174,5	172,0
11	57,2	215,6	219,0	228,2	235.4	244,5	249,6	253,7	250,2	235,7	220,5	198,6	184,8	177,2	174,7
12	49,3	217,0	219,8	229,3	236,6	246,0	251,2	254,5	251,7	237,2	222,0	199,6	185,6	177,8	175,7

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	<	1500	pF	←
		>	1000	pF	←
Final accelerator to metal band	$C_{a,g3,g5/m'}$		250	pF	
Cathode to all	C_k		3	pF	
Grid no. 1 to all	C_{g1}		7	pF	

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal	110°
Horizontal deflection angle	98°
Vertical deflection angle	81°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 130	V*)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62	V

---

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	23 14	kV*) kV
Grid no. 4 voltage				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max. min.	200 80	V**) V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current,				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current,				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

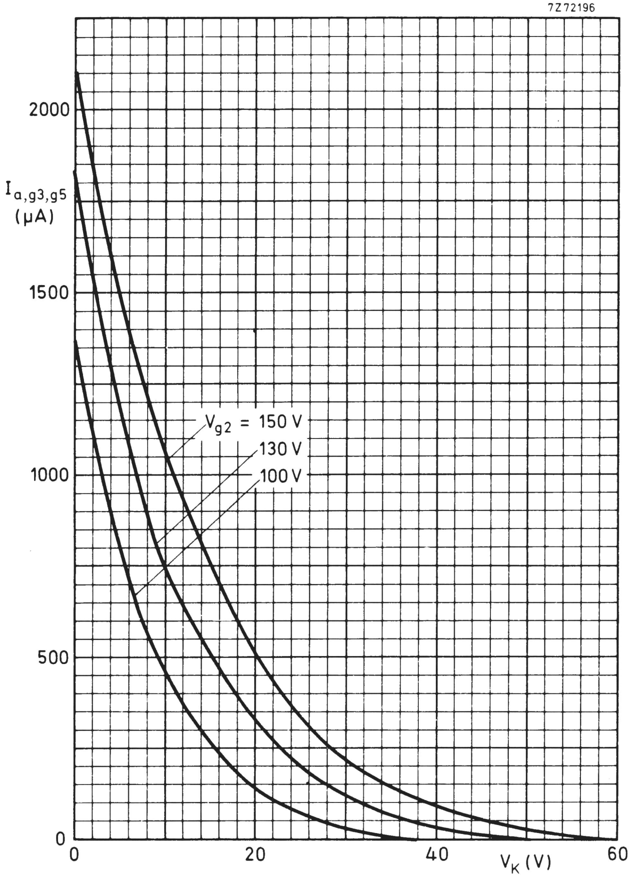
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

---

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

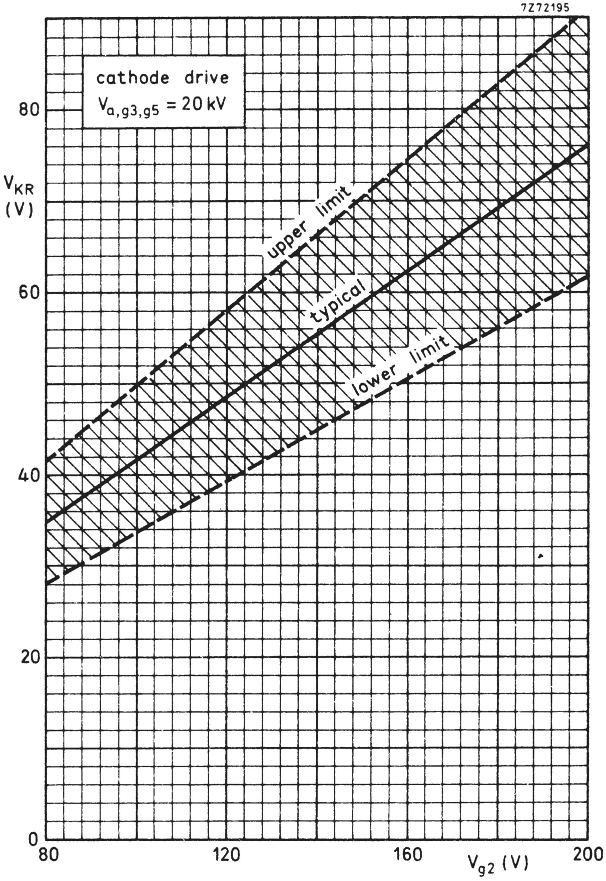
**) At $V_{g1/k} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.



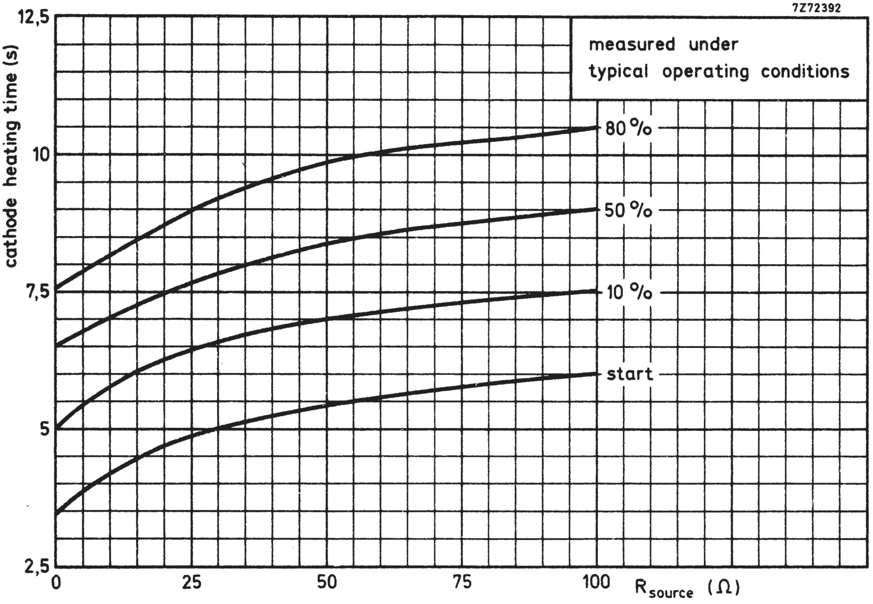
Final accelerator current as a function of cathode voltage

Cathode drive $V_{a,g3,g5} = 20$ kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

61 cm (24 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV.

QUICK REFERENCE DATA			
Face diagonal		61	cm (24 in)
Deflection angle		110°	
Overall length	max.	370	mm
Neck diameter		28,6	mm
Heating	6,3 V,	300	mA
Grid no. 2 voltage		400	V
Final accelerator voltage		20	kV

SCREEN

Metal-backed phosphor

Luminescence	white		
Light transmission of face glass	≈		42%
Useful diagonal	≥	577,5	mm
Useful width	≥	481	mm
Useful height	≥	375	mm

HEATING

Indirect by a.c. or d.c.; series or parallel supply

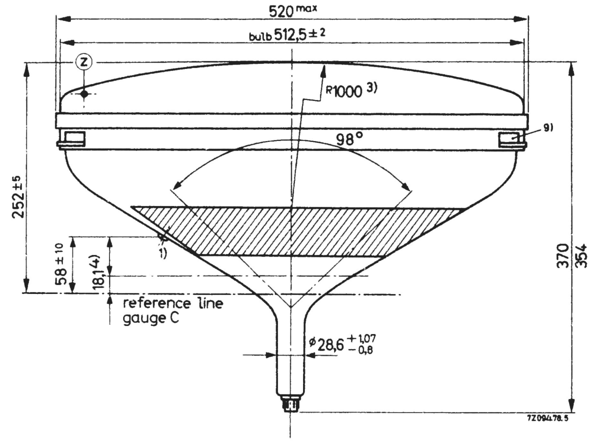
Heater current	I_f	300	mA
Heater voltage	V_f	6,3	V

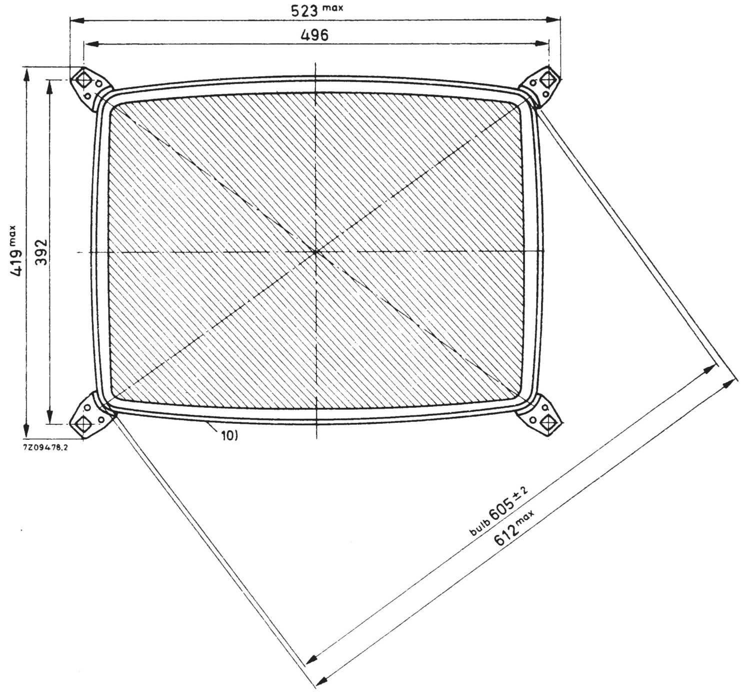
If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

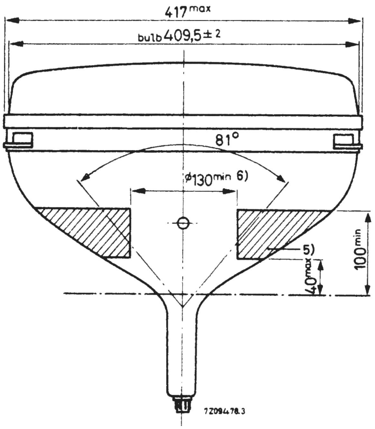
MECHANICAL DATA

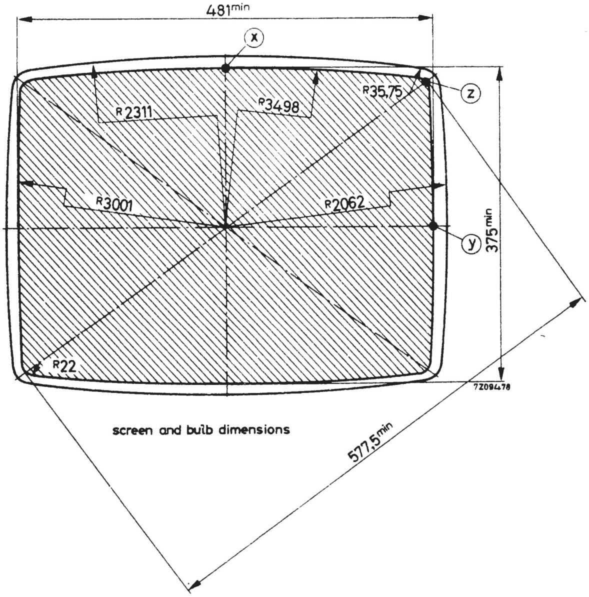
Dimensions in mm

Notes are given after the drawings.

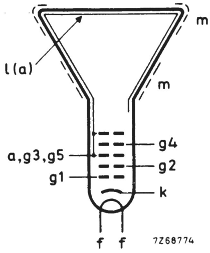

520 max
bulb 512,5 ± 2
Z
R1000 3)
98°
9)
252±5
58 ± 10
18,1 4)
1)
reference line
gauge C
370
354
ø28,6 +1,07 −0,8
7Z09478.5

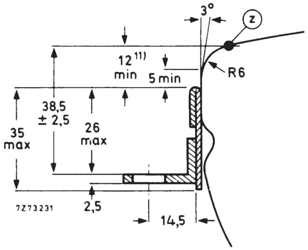

523 max
496
419 max
392
10)
7Z09478.2
bulb 605 ± 2
612 max

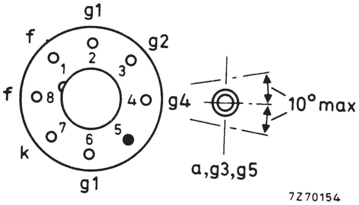

417 max
bulb 409,5 ± 2
81°
∅130 min 6)
5)
100 min
40 max
7Z09478.3

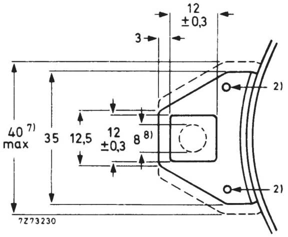

481 min
x
R2311
R3498
R35,75
z
R3001
R2062
y
375 min
R22
7Z09478
577,5 min

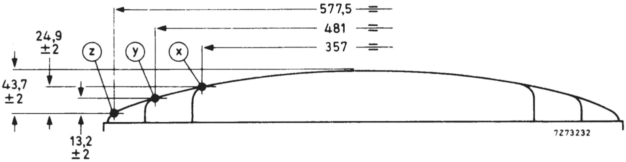
screen and bulb dimensions


m'
l(a)
m
a,g3,g5
g1
g4
g2
k
f f
7Z68774


3°
z
R6
12 11)
min
5 min
38,5
± 2,5
35
max
26
max
2,5
14,5
7Z73231


g1
f
g2
f
g4
k
g1
1
2
3
4
5
6
7
8
10° max
a,g3,g5
7Z70154


12
±0,3
3
2)
40 7)
max
35
12,5
12
±0,3
8 8)
2)
7Z73230


577,5
481
357
24,9
±2
z
y
x
43,7
±2
13,2
±2
7Z73232

Mounting position: any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC-67-I-31a

Net mass : approx. 13, 5 kg.

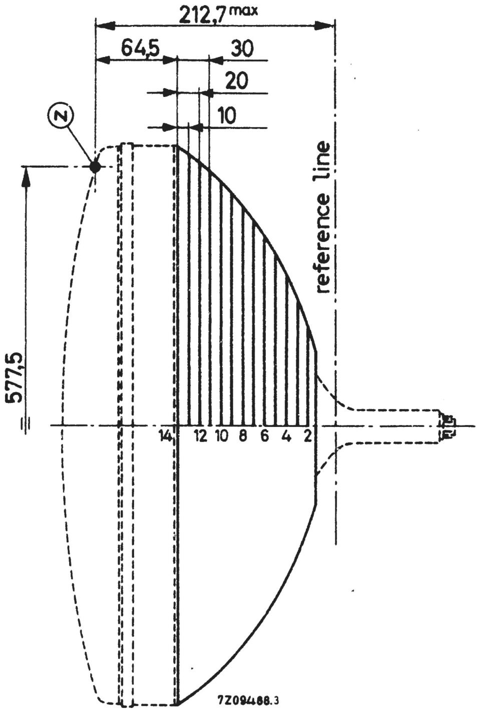
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

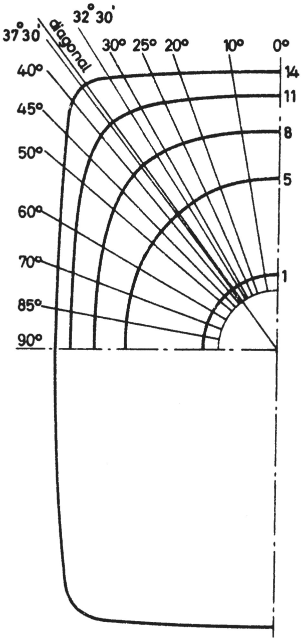
1. Small cavity contact I E C -67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position; i.e. at the corners of a rectangle of 496 x 392 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. The max. outer contour of the tube with the rim-band is determined by adding 5 mm to the nominal bulb dimensions.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



7Z09488.3



Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
1	130	72, 9	72, 4	71, 6	71, 1	70, 7	70, 5	70, 3	70, 3	70, 2	70, 1	70, 0	70, 2	70, 8	71, 5	71, 8
2	120	104, 4	102, 6	99, 4	97, 8	96, 5	96, 0	95, 2	95, 1	94, 7	94, 2	94, 0	94, 5	96, 0	98, 0	99, 3
3	110	134, 3	131, 5	126, 5	124, 2	122, 1	121, 2	119, 9	119, 6	119, 0	118, 0	117, 4	117, 4	118, 7	120, 7	122, 0
4	100	160, 4	157, 1	151, 1	148, 1	145, 3	144, 1	142, 2	141, 8	140, 8	139, 1	137, 9	136, 7	136, 9	137, 9	138, 7
5	90	178, 7	176, 9	172, 9	170, 1	167, 5	166, 1	164, 0	163, 5	162, 3	159, 9	157, 8	154, 3	151, 9	150, 7	150, 3
6	80	193, 3	193, 0	191, 4	189, 9	187, 8	186, 6	184, 4	183, 4	182, 4	179, 2	175, 9	169, 6	164, 4	161, 0	159, 8
7	70	205, 7	206, 5	207, 6	207, 5	206, 4	205, 5	203, 4	202, 8	201, 1	196, 9	192, 2	182, 7	174, 8	169, 7	168, 0
8	60	216, 8	212, 5	222, 1	223, 5	223, 8	223, 4	221, 5	220, 9	218, 9	213, 6	207, 2	194, 3	183, 9	177, 6	175, 4
9	50	226, 9	229, 3	235, 0	238, 1	240, 0	240, 3	238, 9	238, 2	235, 9	229, 0	220, 7	204, 4	192, 1	184, 7	182, 3
10	40	236, 0	238, 7	246, 3	250, 9	254, 9	256, 1	255, 4	254, 7	252, 4	243, 2	232, 7	213, 3	199, 3	191, 2	188, 6
11	30	243, 7	246, 8	255, 9	262, 0	268, 1	270, 6	271, 0	270, 3	267, 4	256, 0	243, 1	220, 8	205, 7	197, 1	194, 3
12	20	250, 0	253, 4	263, 5	270, 9	279, 3	283, 5	285, 5	284, 8	281, 6	267, 2	251, 8	227, 2	211, 1	202, 2	199, 4
13	10	255, 0	258, 5	269, 3	277, 7	288, 1	293, 9	298, 0	297, 6	294, 1	276, 2	258, 5	232, 1	215, 6	206, 5	203, 6
14	0	258, 5	262, 0	273, 1	281, 9	293, 2	300, 0	305, 4	305, 1	301, 5	281, 6	262, 7	235, 6	218, 8	209, 6	206, 6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	< 2500 pF > 1500 pF	
Final accelerator to metal band	Ca, g3, g5/m'	350 pF	←
Cathode to all	C_k	5 pF	
Grid no. 1 to all	C_{g1}	7 pF	

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	98°
Vertical deflection angle	81°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Grid drive service

Final accelerator voltage	$V_{a, g3, g5}$	20 kV
Focusing electrode voltage	V_{g4}	0 to 400 V*)
Grid no. 2 voltage	V_{g2}	400 V
Grid no. 1 voltage for visual exinction of focused raster	V_{GR}	-40 to -77 V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a, g3, g5}$	20 kV
Focusing electrode voltage	V_{g4}	0 to 400 V*)
Grid no. 2 voltage	V_{g2}	400 V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66 V

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*) Individual tubes will have optimum focus within this range. In general an acceptable picture will be obtained with a fixed focus voltage.

LIMITING VALUES (Design max. rating system)

→ Final accelerator voltage at Ia, g3, g5 = 0	Va, g3, g5	max. min.	23 14	kV*) kV
Grid no. 4 voltage,				
positive	Vg4	max.	1000	V
negative	-Vg4	max.	500	V
Grid no. 2 voltage	Vg2	max. min.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	Vg2/g1	max.	850	V
Grid no. 1 voltage				
positive	Vg1	max.	0	V
positive peak	Vg1p	max.	2	V
negative	-Vg1	max.	200	V
negative peak	-Vg1p	max.	400	V**)
Cathode-to-heater voltage,				
positive	Vk/f	max.	250	V
positive peak	Vk/fp	max.	300	V
negative	-Vk/f	max.	200	V
positive during equipment warm-up period not exceeding 15 s	Vk/f	max.	450	V****)

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*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but maximum 1, 5 ms.

***) At $V_{g1/k}$ = 0 V.

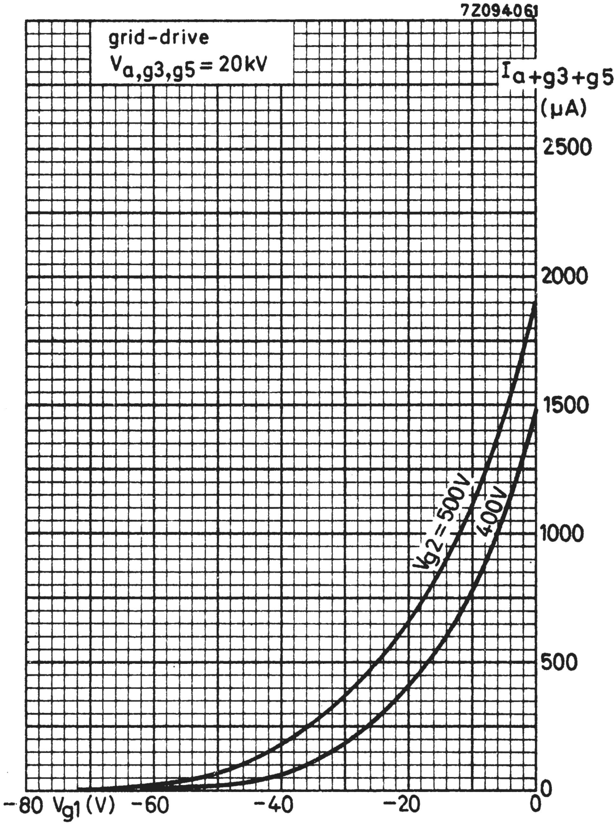
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

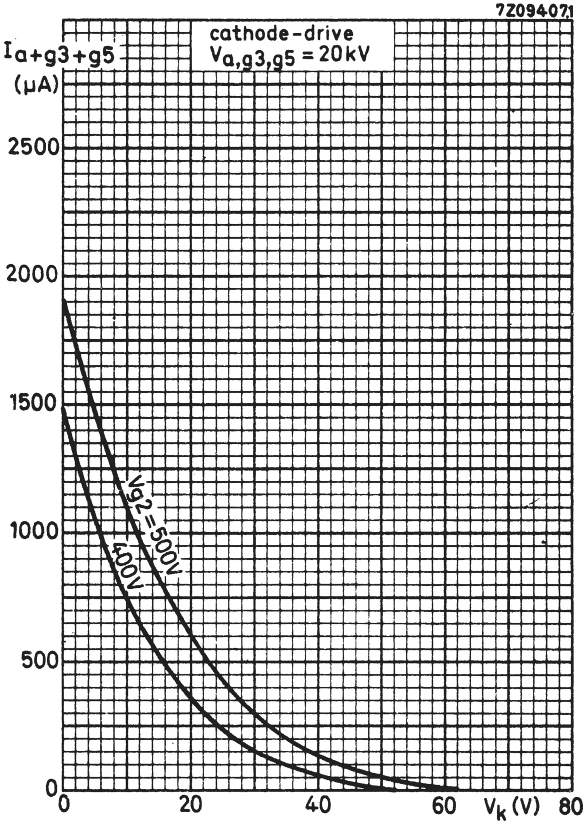
Grid no. 4 current,				
positive	Ig4	max.	25	μA
negative	-Ig4	max.	25	μA
Grid no. 2 current				
positive	Ig2	max.	5	μA
negative	-Ig2	max.	5	μA

MAXIMUM CIRCUIT VALUES

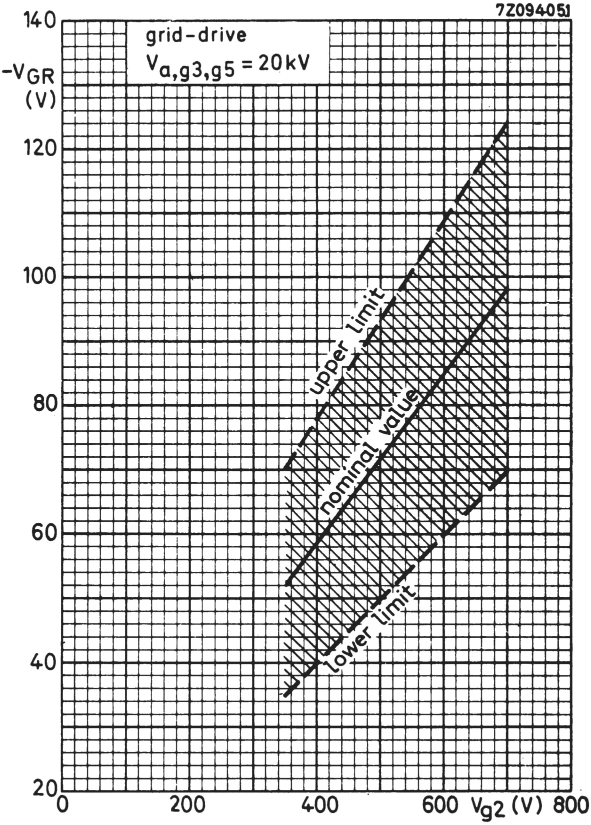
Resistance between cathode and heater	Rk/f	max.	1	MΩ
Impedance between cathode and heater	Zk/f(50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	Rg1	max.	1, 5	MΩ
Grid no. 1 circuit impedance	Zg1(50 Hz)	max.	0, 5	MΩ



Final accelerator current as a function of grid no. 1 voltage.

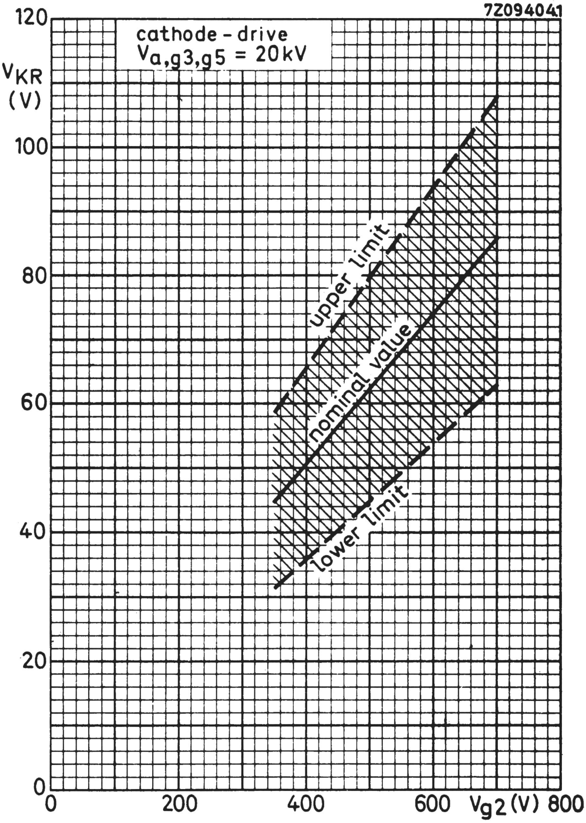


Final accelerator current as a function of cathode voltage.



$$\frac{\Delta V_{GR}}{\Delta V_{a,\,g3,\,g5}} = 0,15 \times 10^{-3}$$

Limits of grid no. 1 cut-off voltage as a function of grid no. 2 voltage.



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,15 \text{ X } 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.

TV PICTURE TUBE

61 cm (24 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA		
Face diagonal		61 cm
Deflection angle		110°
Overall length	max.	370 mm
Neck diameter		28, 6 mm
Heating		6, 3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode		with a typical tube a legible picture will appear within 5 s.

SCREEN

Metal-backed phosphor

Luminescence	white	
Light transmission of face glass	≈	42 %
Useful diagonal	≥	577, 5 mm
Useful width	≥	481 mm
Useful height	≥	375 mm

HEATING

Indirect by a.c. or d.c.,

Heater voltage	V_f		6, 3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7, 3 V *) 5, 3 V

For heating time as a function of source impedance see last page of this data sheet.

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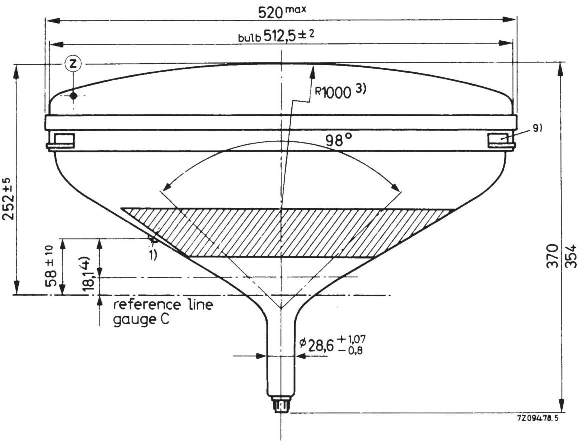
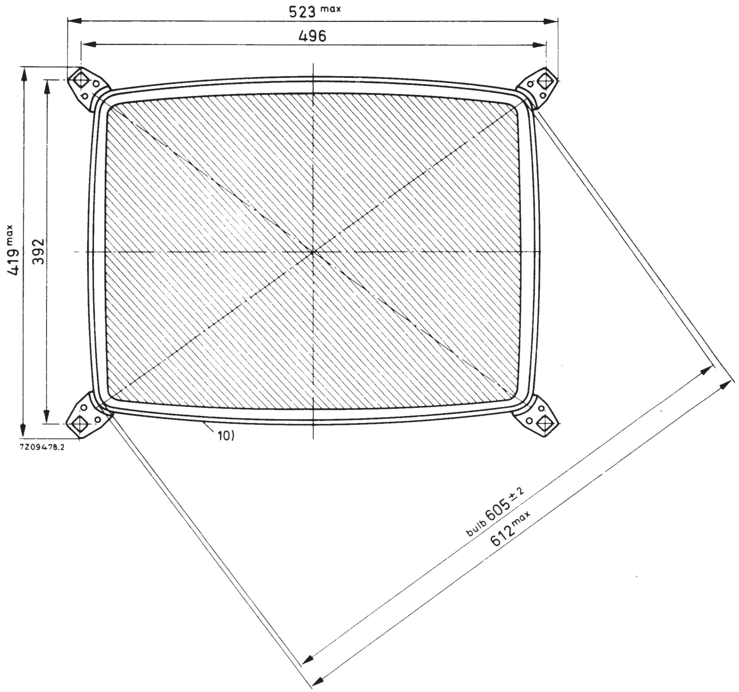
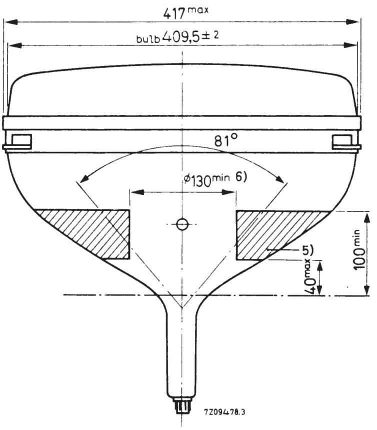
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

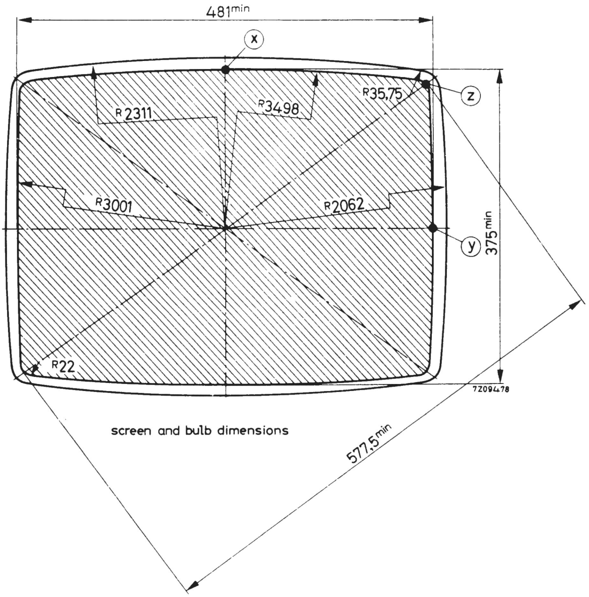
MECHANICAL DATA Dimensions in mm

Notes are given after the drawings.

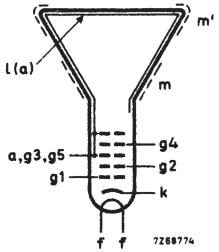

520 max
bulb 512,5 ± 2
Z
R1000 3)
98°
9)
252 ± 5
1)
58 ± 10
18,1 4)
reference line
gauge C
⌀ 28,6 +1,07 −0,8
370
354
7Z09478.5

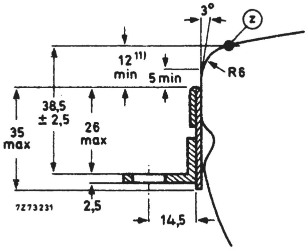

523 max
496
419 max
392
10)
7Z09478.2
bulb 605 ± 2
612 max

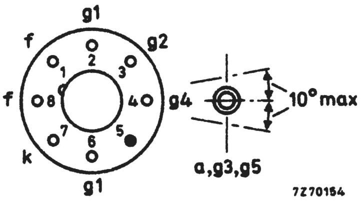

417 max
bulb 409,5 ± 2
81°
⌀130 min 6)
5)
100 min
40 max
7Z09478.3

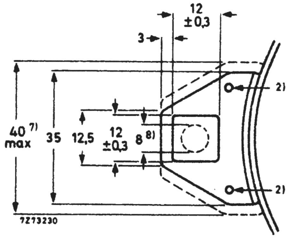

481 min
x
z
y
R2311
R3498
R35,75
R3001
R2062
R22
375 min
577,5 min
7Z09478

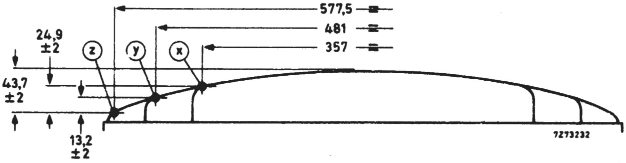
screen and bulb dimensions


m'
l(a)
m
a,g3,g5
g4
g1
g2
k
f f
7Z68774


3°
z
12 11)
min
5 min
R6
38,5
± 2,5
35
max
26
max
7Z73231
2,5
14,5


g1
f
g2
1
2
3
f
8
4
g4
10°max
7
6
5
k
g1
a,g3,g5
7Z70154


12
±0,3
3
2)
40 7)
max
35
12,5
12
±0,3
8 8)
2)
7Z73230


577,5
481
357
24,9
±2
z
y
x
43,7
±2
13,2
±2
7Z73232

Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC-67-I-31a

Net mass : approx. 13,5 kg

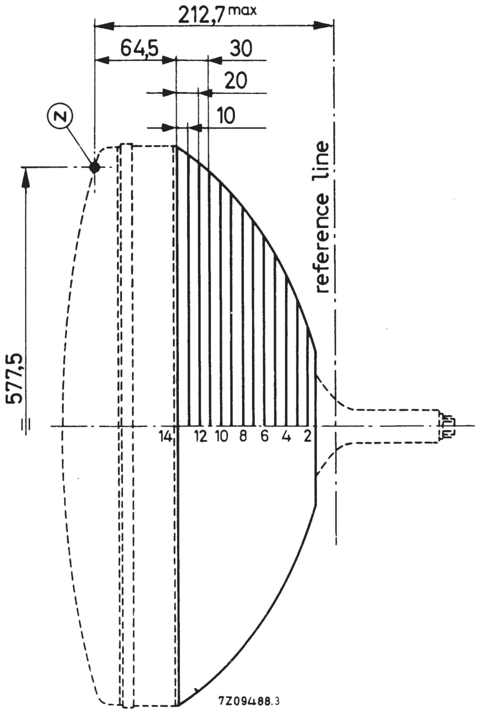
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

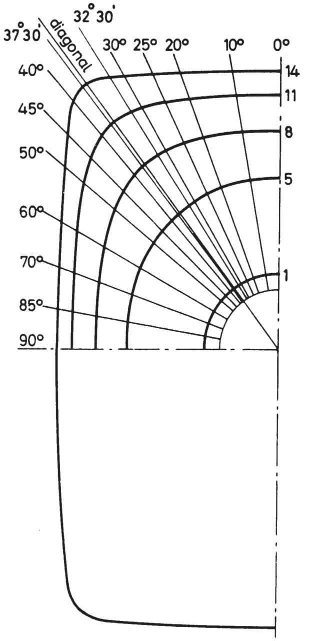
NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position; i.e. at the corners of a rectangle of 496 x 392 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. The max. outer contour of the tube with the rim-band is determined by adding 5 mm to the nominal bulb dimensions.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm





Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
1	130	72,9	72,4	71,6	71,1	70,7	70,5	70,3	70,3	70,2	70,1	70,0	70,2	70,8	71,5	71,8
2	120	104,4	102,6	99,4	97,8	96,5	96,0	95,2	95,1	94,7	94,2	94,0	94,5	96,0	98,0	99,3
3	110	134,3	131,5	126,5	124,2	122,1	121,2	119,9	119,6	119,0	118,0	117,4	117,4	118,7	120,7	122,0
4	100	160,4	157,1	151,1	148,1	145,3	144,1	142,2	141,8	140,8	139,1	137,9	136,7	136,9	137,9	138,7
5	90	178,7	176,9	172,9	170,1	167,5	166,1	164,0	163,5	162,3	159,9	157,8	154,3	151,9	150,7	150,3
6	80	193,3	193,0	191,4	189,9	187,8	186,6	184,4	183,4	182,4	179,2	175,9	169,6	164,4	161,0	159,8
7	70	205,7	206,5	207,6	207,5	206,4	205,5	203,4	202,8	201,1	196,9	192,2	182,7	174,8	169,7	168,0
8	60	216,8	212,5	222,1	223,5	223,8	223,4	221,5	220,9	218,9	213,6	207,2	194,3	183,9	177,6	175,4
9	50	226,9	229,3	235,0	238,1	240,0	240,3	238,9	238,2	235,9	229,0	220,7	204,4	192,1	184,7	182,3
10	40	236,0	238,7	246,3	250,9	254,9	256,1	255,4	254,7	252,4	243,2	232,7	213,3	199,3	191,2	188,6
11	30	243,7	246,8	255,9	262,0	268,1	270,6	271,0	270,3	267,4	256,0	243,1	220,8	205,7	197,1	194,3
12	20	250,0	253,4	263,5	270,9	279,3	283,5	285,5	284,8	281,6	267,2	251,8	227,2	211,1	202,2	199,4
13	10	255,0	258,5	269,3	277,7	288,1	293,9	298,0	297,6	294,1	276,2	258,5	232,1	215,6	206,5	203,6
14	0	258,5	262,0	273,1	281,9	293,2	300,0	305,4	305,1	301,5	281,6	262,7	235,6	218,8	209,6	206,6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,\,g3,\,g5/m}$	< 2500 > 1500	pF pF
Final accelerator to metal band	$C_{a,\,g3,\,g5/m'}$	350	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	98°
Vertical deflection angle	81°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).

Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,\,g3,\,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 130	V 1)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62	V

---

1) Because of the flat focus characteristic it is suffient to choose a focusing voltage between 0 and 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may between −100 V and +200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max.	23	kV*)
		min.	14	kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max.	200	V**)
		min.	80	V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1_p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1_p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

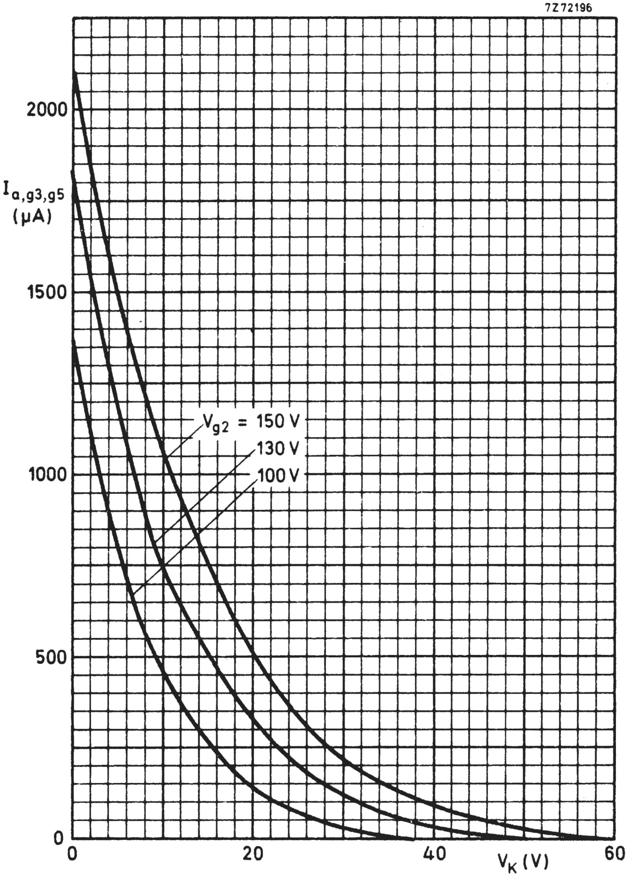
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0, 5	MΩ

---

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

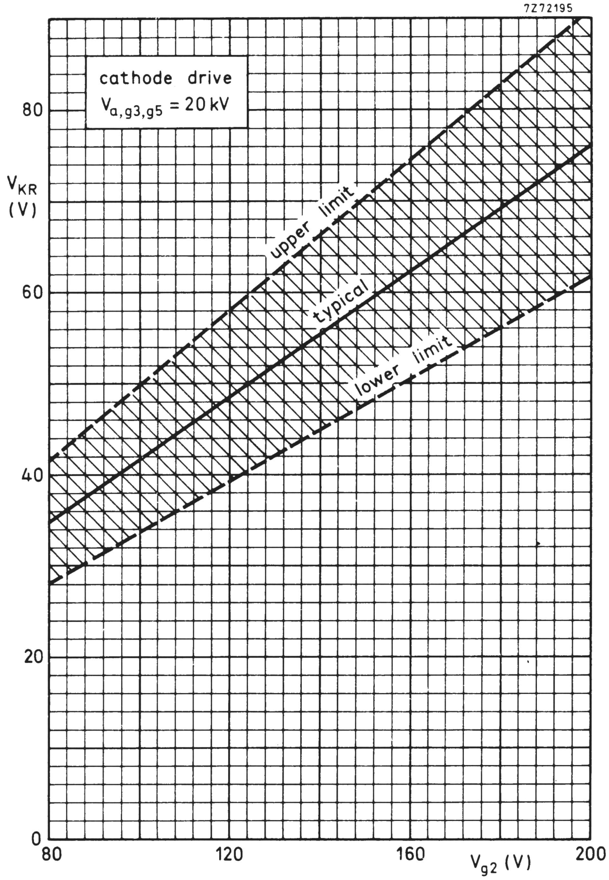
**) At $V_{k/g1} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1, 5 ms.



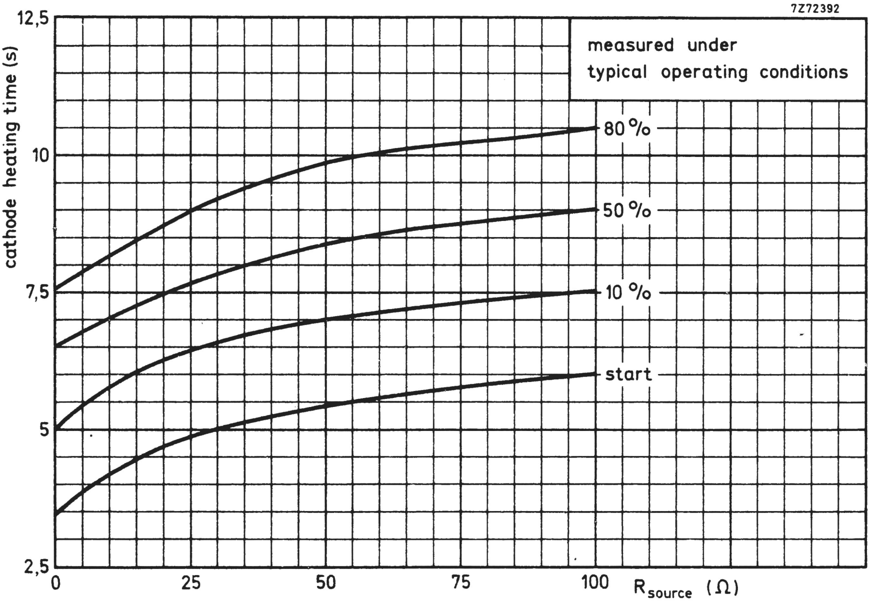
Final accelerator current as a function of cathode voltage.

Cathode drive $V_{a,g3,g5}$ = 20 kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

COLOUR MONITOR TUBES
FOR DATA GRAPHIC DISPLAY

D

HIGH RESOLUTION COLOUR DISPLAY TUBE

- 90° deflection angle
- 37 cm (14 in) face diagonal
- 29,1 mm neck diameter
- High resolution obtained by extremely small dot triplet pitch
- Black matrix screen for high brightness and contrast
- High resolution in-line electron guns
- Quick-heating cathodes
- Internal magnetic shield
- Rimband type implosion protection
- When combined with an appropriate hybrid saddle toroidal deflection unit of the AT1331 series, it forms a self-converging assembly; dynamic convergence is not required. Pre-aligned assemblies are available.

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	37 cm (14 in)
Overall length	351 mm
Neck diameter	29,1 mm
Dot triplet pitch	0,31 mm (0,012 in)
Resolution: minimum number of displayable pixels*	800 x 690
Heating	6,3 V/662 mA
Focusing voltage	24% of anode voltage

APPLICATION

For use in monitors as a character and graphic display tube in science, medicine and industry.

The appropriate deflection unit of the AT1331 series, and the magnets for static convergence and colour purity are recommended to be used with this tube.

---

* Pixel = picture element.

ELECTRICAL DATA

Capacitances		
anode to external conductive coating including rimband	$C_{a(m+m')}$	max. 1300 pF min. 800 pF
grid 1 of any gun to all other electrodes	C_{g1}	13,6 pF
cathodes of all guns, connected in parallel, to all other electrodes	C_k	14,8 pF
cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5 pF
focusing electrode to all other electrodes	C_{g3}	5,5 pF
Electron guns		unitized triple-aperture electrodes
Focusing method		electrostatic
Focus lens		bi-potential
Convergence method		magnetic
Deflection method		magnetic
Deflection angles		
diagonal		approx. 90°
horizontal		approx. 78°
vertical		approx. 60°
Heating		indirect by a.c. or d.c.
heater voltage	V_f	6,3 V
heater current	I_f	662 mA

OPTICAL DATA

Screen	metal-backed phosphor dot triplets; black matrix
Screen finish	high gloss*
Phosphor	
red	rare earth
green	sulphide type
blue	sulphide type
Dot arrangement	hexagonal (horizontal in-line)
Spacing between centres of adjacent dot triplets	approx. 0,31 mm (0,012 in)
Light transmission of face glass at centre	approx. 86%

---

* Non-glare versions are available on request.

MECHANICAL DATA (see also the figures on the following pages)

Overall length	351,1 ± 9,5 mm
Neck diameter	29,1 ± 0,7 mm
Greatest dimensions of tube face (excluding mounting lugs)	
diagonal	368,6 ± 2,4 mm
width	317,6 ± 2,4 mm
height	248,6 ± 2,4 mm
Minimum useful screen dimensions (projected)	
diagonal	335,4 mm
horizontal axis	280,8 mm
vertical axis	210,6 mm
Recommended useful screen dimensions for alphanumeric display	
diagonal	307 mm
horizontal axis	244 mm
vertical axis	186 mm
Implosion protection	shrink type (UL and CSA approved)
Anode contact designation	JEDEC J1-21; IEC67-III-2
Base designation	JEDEC B10-278
Basing designation	JEDEC 10P
Mass	approx. 6,4 kg
Mounting position	anode contact on top

Notes to outline drawings on the following pages

1. Reference line, determined by the plane of the upper edge of the flange of the reference line gauge (EIAJ no. G-R90CJ4) when the gauge is resting on the cone.
2. The socket for this base should not be rigidly mounted: it should have flexible leads and be allowed to move freely. The bottom circumference of the base will fall within a circle concentric with the tube axis and having a diameter of 55 mm. The mass of the mating socket with circuitry should not be more than 150g; maximum permissible torque is 40 mNm.
3. Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
4. To clean this area, wipe only with a soft lintless cloth.
5. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
6. Minimum space to be reserved for mounting lug.
7. The position of the mounting screws must be within a circle of 8,0 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 313,8 mm x 245,8 mm.

MECHANICAL DATA
(continued)

Notes are on the preceding page.

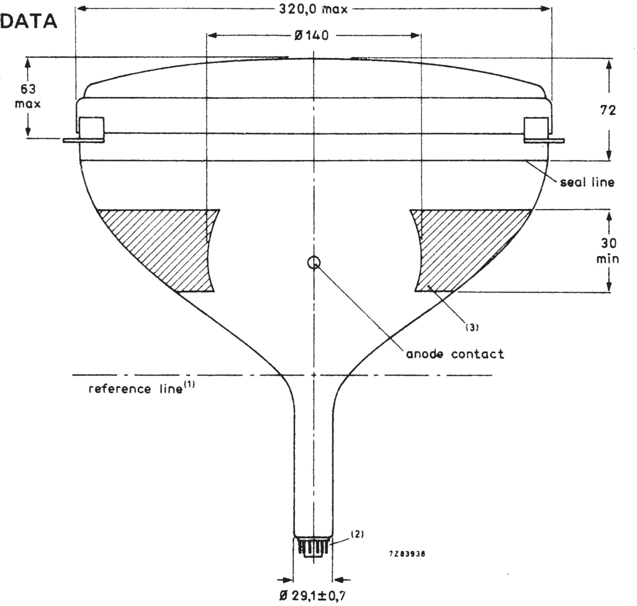

320,0 max
Ø140
63
max
72
seal line
30
min
(3)
anode contact
reference line(1)
(2)
7Z83938
Ø 29,1±0,7

Fig. 1a.

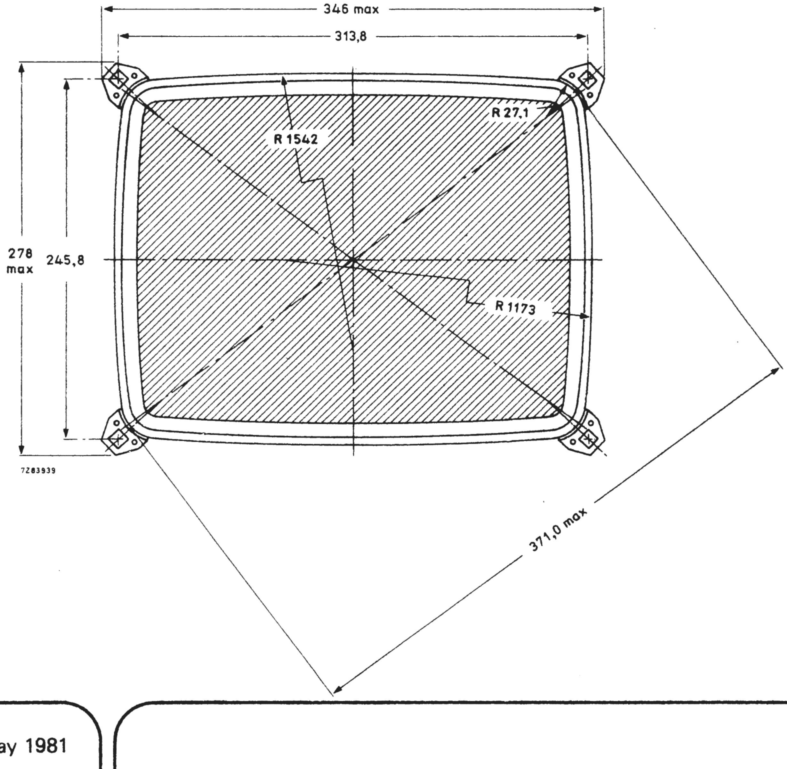

346 max
313,8
R 27,1
R 1542
278
max
245,8
R 1173
7Z83939
371,0 max

Fig. 1b.

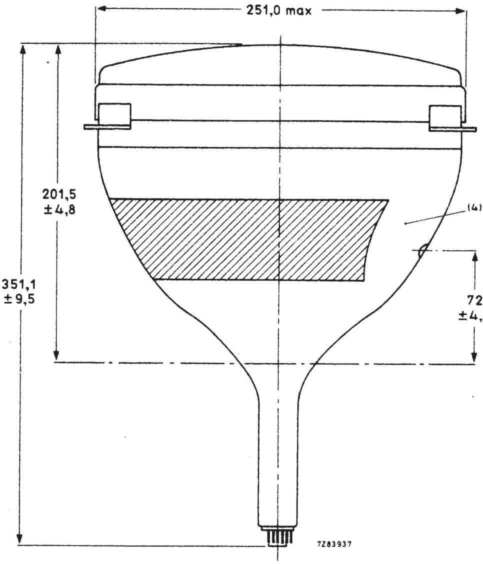

251,0 max
201,5 ±4,8
351,1 ±9,5
(4)
72 ±4,8
7Z83937

Fig. 1c.

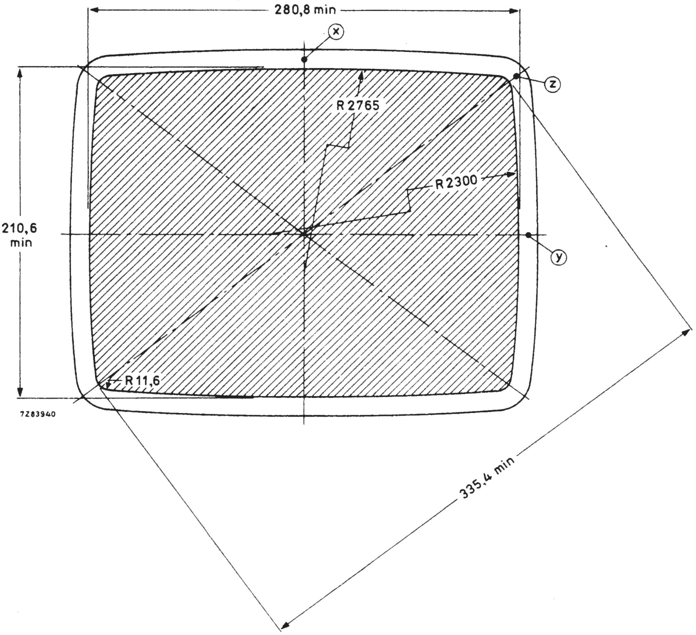

280,8 min
x
z
R 2765
R 2300
210,6 min
y
R 11,6
7Z83940
335,4 min

Fig. 2.

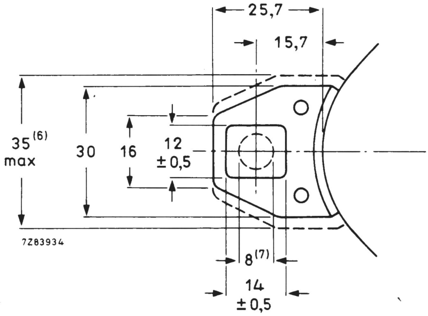

25,7
15,7
35 (6) max
30
16
12 ± 0,5
8 (7)
14 ± 0,5
7Z83934

Fig. 3

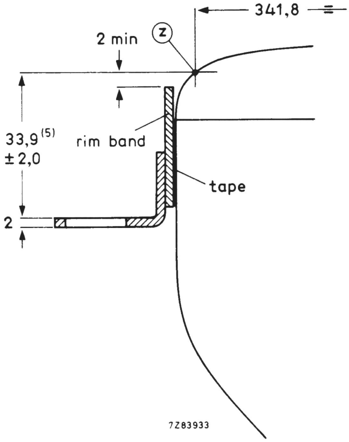

341,8
2 min
z
33,9 (5) ± 2,0
rim band
tape
2
7Z83933

Fig. 4.

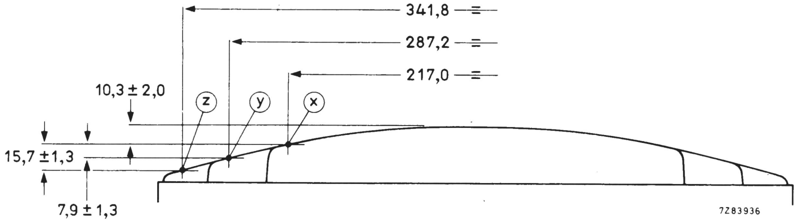

341,8
287,2
217,0
10,3 ± 2,0
z
y
x
15,7 ± 1,3
7,9 ± 1,3
7Z83936

Fig. 5.

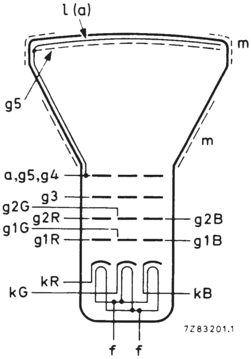

l (a)
m'
g5
m
a,g5,g4
g3
g2G
g2R
g2B
g1G
g1R
g1B
kR
kG
kB
f
f
7Z83201.1

Fig. 6

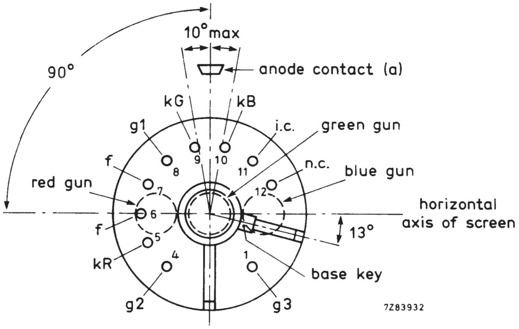

90°
10° max
anode contact (a)
kG
kB
g1
i.c.
green gun
f
n.c.
blue gun
red gun
horizontal axis of screen
13°
f
kR
base key
g2
g3
1
4
5
6
7
8
9
10
11
12
7Z83932

Fig. 7.
i.c. = internally connected (not to be used);
n.c. = not connected.

It is recommended to earth pin 12 (n.c.) to avoid possible noise caused by discharging from that pin.

RECOMMENDED OPERATING CONDITIONS (cathode drive)

The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	25 kV	
Grid 3 (focusing electrode) voltage	V_{g3}	5,5 to 6,5 kV	note 1
Grid 2 voltage for a spot cut-off voltage V_k = 100 V	V_{g2}	250 to 570 V	
Anode current of each gun (peak)	I_{ap}	300 μA	
Luminance at the centre of the screen L			
white (CIE co-ordinates: x = 0,313, y = 0,329)		65 cd/m²	note 2
white (CIE co-ordinates: x = 0,281, y = 0,311)		68 cd/m²	
red		37 cd/m²	
green		135 cd/m²	
blue		25 cd/m²	
Minimum number of displayable pixels		800 x 690	note 3

Notes

1. To obtain optimum focus over the whole display area, the dynamic focusing voltage shown in the Dynamic Focusing Design Chart (Fig. 10) should be applied.
2. Tube adjusted for a focused raster with a current density of 0,4 μA/cm² of the respective colour.
3. Measuring conditions:
   scanning = horizontal;
   anode current per gun (peak value) = 300 μA;
   pulse width equal to the dot pitch;
   screen area used = 244 mm x 186 mm.

EQUIPMENT DESIGN VALUES (each gun if applicable)

The values are valid for anode voltages between 20 and 27,5 kV.
The voltages are specified with respect to grid 1.

Grid 3 (focusing electrode) voltage	V_{g3}	22 to 26% of anode voltage
Grid 2 voltage for visual extinction of focused spot	V_{g2} and V_k	see cut-off design chart (Fig. 11)
Difference in cut-off voltages between guns in any tube ($V_k = 100$ V)	ΔV_k	lowest value ⩾ 80% of highest value
Video drive characteristic		see graph, Fig. 12
Grid 3 (focusing electrode) current	I_{g3}	−10 to +10 μA
Grid 2 current	I_{g2}	−5 to +5 μA
Grid 1 current at $V_k = 100$ V	I_{g1}	−5 to +5 μA
Phosphor colour co-ordinates*		
red		x = 0,610; y = 0,340
green		x = 0,280; y = 0,590
blue		x = 0,152; y = 0,063

	to produce white, CIE co-ordinates					
	x = 0,313 y = 0,329			x = 0,281 y = 0,311		
Percentage of total anode current supplied by each gun (typical)						
red gun	46%			36%		
green gun	36%			40%		
blue gun	18%			24%		
Ratio of anode currents	min.	av.	max.	min.	av.	max.
red gun to green gun	0,90	1,28	1,70	0,60	0,90	1,20
red gun to blue gun	1,90	2,55	3,30	1,10	1,50	1,90
blue gun to green gun	0,30	0,50	0,80	0,40	0,60	0,80

BEAM CORRECTIONS

Required centring, measured at the centre of the screen in any direction	max. 4,0 mm
Correction that must be supplied by purifying magnet to compensate for mis-register in any direction	max. 0,07 mm
Required correction for static convergence, in any direction	
red to blue	max. 4,0 mm
red and blue to green	max. 1,8 mm

---

* Other phosphors are available on request.

LIMITING VALUES (each gun if applicable)

Design maximum rating system unless otherwise stated.
The voltages are specified with respect to grid 1.

Anode voltage	$V_{a,g4}$	max.	27,5	kV	notes 1 and 2
		min.	20	kV	note 3
Anode current for each gun					
peak	I_{ap}	max.	400	μA	
average	I_a	max.	200	μA	
Grid 3 (focusing electrode) voltage	V_{g3}	max.	10	kV	
Grid 2 voltage, peak	V_{g2p}	max.	1000	V	
Cathode voltage					
positive	V_k	max.	400	V	
positive operating cut-off	V_k	max.	140	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Cathode to heater voltage					
positive	V_{kf}	max.	275	V	note 4
positive peak	V_{kfp}	max.	300	V	note 1
negative	$-V_{kf}$	max.	150	V	
negative peak	$-V_{kfp}$	max.	180	V	note 1
Heater voltage	V_f	max.	6,9	V	note 5
		min.	5,7	V	

LIMITING CIRCUIT VALUES

Grid 3 circuit resistance	R_{g3}	max.	30	MΩ
Grid 1 to cathode circuit resistance (each gun)	R_{g1k}	max.	0,75	MΩ

DEVELOPMENT SAMPLE DATA

Notes

1. Absolute Maximum rating system.
2. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended first to make the necessary adjustments for normal operation.
3. Operation of the tube at lower voltages impairs the luminance and resolution.
4. During an equipment warm-up period not exceeding 15 s, V_{kf} is allowed to rise to 385 V.
5. For maximum cathode life, it is recommended that the heater supply be regulated at 6,0 V. For 'instant on' applications, a maximum heater voltage of 5 V (design maximum value) may be maintained on the tube when the receiver is in the 'off' (standby) position; all other voltages normally applied to the tube must be removed during standby operation.

X-RADIATION LIMIT

Maximum anode voltage at which the X-radiation emitted will not exceed 0,5 mR/h at an anode current of 300 μA

entire tube	31 kV*
face-plate only	33 kV

Warning:

If the value for the tube face only is used as design criterion, adequate shielding must be provided in the monitor for the anode contact and/or certain portions of the tube funnel and panel skirt to insure that the X-radiation from the monitor is attenuated to a value equal to or lower than that specified for the face of the tube.

Maximum voltage difference between anode and focus electrode at which the X-radiation will not exceed 0,5 mR/h	30 kV

Warning:

If the voltage value above can be exceeded in the monitor additional attenuation of the X-radiation through the tube neck may be required.

The X-radiation emitted from this display tube, as measured in accordance with the procedure of JEDEC Publication No. 64D, will not exceed 0,5 mR/h throughout the useful tube life when operated within the 'Design maximum ratings'.

The tube should not be operated beyond its 'Design maximum ratings' stated above, but its X-radiation will not exceed 0,5 mR/h for anode voltage and current combinations given by the isoexposure-rate limits characteristics shown on the next page.

Operation above the values shown by the curve may result in failure of the monitor to comply with the Federal Performance Standard of the U.S. for Television Receivers, Section 1020. 10 of Part 1020 of Title 21, Code of Federal Regulation (PL90-602) as published in the Federal Register Volume 38, No. 198, Monday, October 15, 1973.

Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve on the next page. X-radiation at a constant anode voltage varies linearly with anode current.

---

* This rating applies only if the anode connector used by the set maker provides the necessary attenuation to reduce the X-radiation from the anode contact by a factor equal to the difference between the anode button isoexposure-rate limit curve and the isoexposure-rate limit curve for the entire tube.

DEVELOPMENT SAMPLE DATA

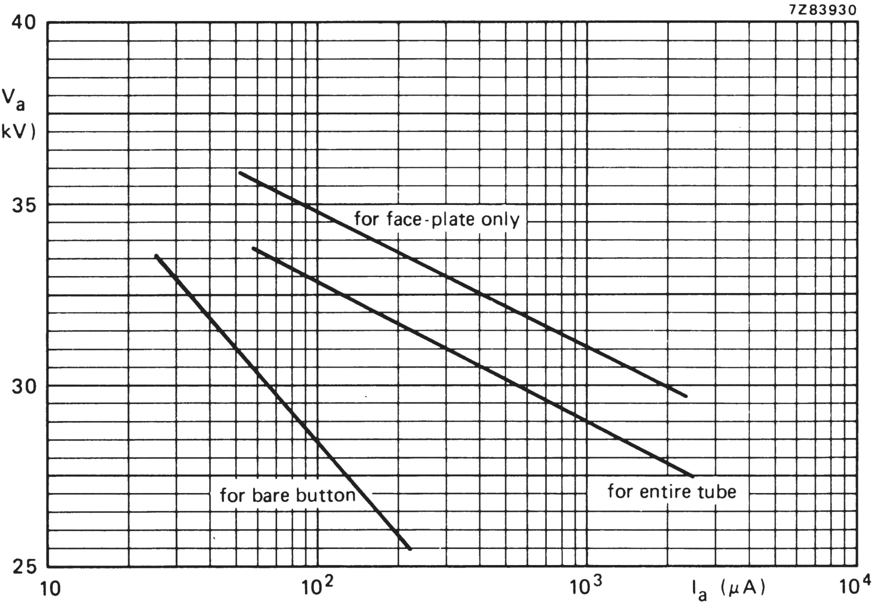


Fig. 8 0,5 mR/h isoexposure-rate limit curve.

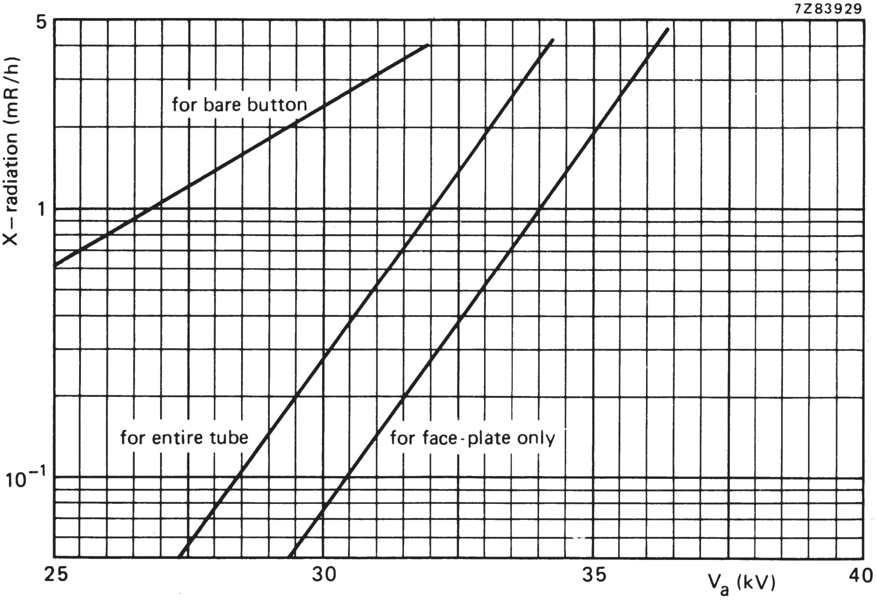


Fig. 9 X-radiation limit curve at a constant anode current of 300 μA.

WARNINGS

X-radiation

Operation of this colour display tube under abnormal conditions which exceed the 0,5 mR/h iso-dose rate curve shown on the preceding page may produce soft X-rays which may constitute a health hazard on prolonged exposure at close range unless adequate external screening is provided. Precautions must therefore be exercised during servicing of monitors using this tube to ensure that the anode voltage and other tube voltages are adjusted to the recommended values so that the 'Design maximum ratings' are not exceeded.

Tube replacement

This display tube incorporates integral X-radiation and implosion protection and must be replaced with a tube of the same type number or a recommended replacement to assure continued safety.

Shock hazard

The high voltage at which the tube is operated may be very dangerous. The monitor should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the display tube since a residual electrical charge may be held by the high-voltage capacitor formed by the external and internal conductive coatings of the display tube funnel. To remove any residual charge, short the anode contact button, located in the funnel of the tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard.

Tube handling

Display tubes should be kept in the shipping box or similar protective container will just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

The packing should incorporate sufficient cushioning so that under normal conditions of shipment or handling an impact acceleration of more than 35g is never applied to the tube.

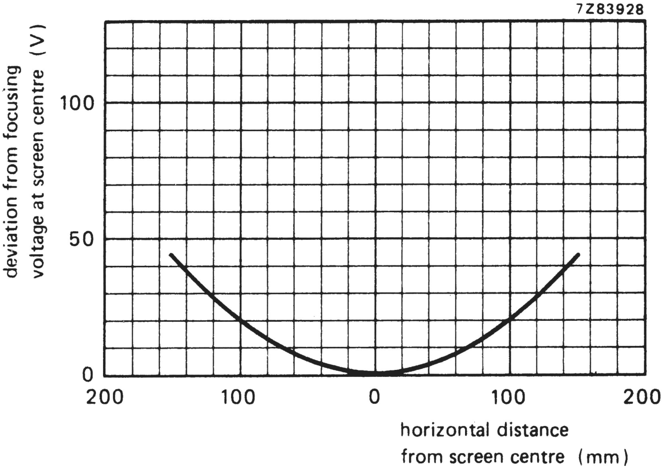


Fig. 10 Dynamic Focusing Design Chart. Measured at V_f = 6,3 V, V_a = 25 kV, V_k = 100 V, deflection unit: AT1331 series.

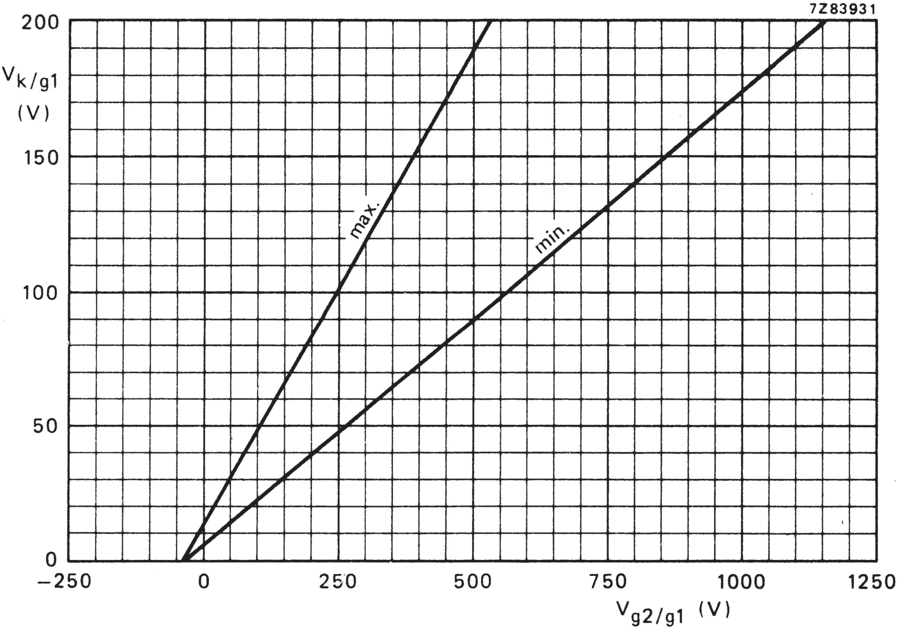


Fig. 11 Spot cut-off design chart (cathode drive), V_f = 6,3 V, V_{g3} adjusted for focus, $V_{a,g4}$ = 20 to 27,5 kV.

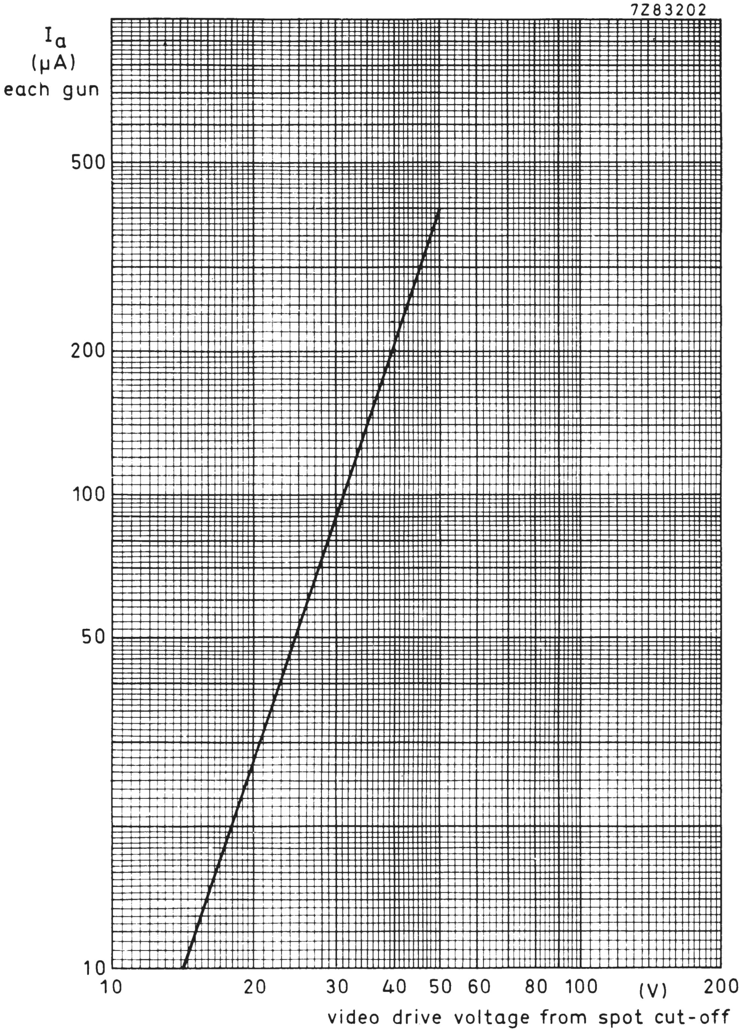


Fig. 12 Typical cathode drive characteristic. Measured at $V_f = 6{,}3$ V, $V_{a,g4} = 20$ to 27,5 kV, V_{g3} adjusted for focus, V_{g2} adjusted to provide spot cut-off for $V_k = 100$ V.

DEGAUSSING

The display tube has an internal magnetic shield. This shield and the shadow mask with its suspension system may be automatically degaussed by a coil mounted on the cone of the picture tube as shown in Fig. 13.

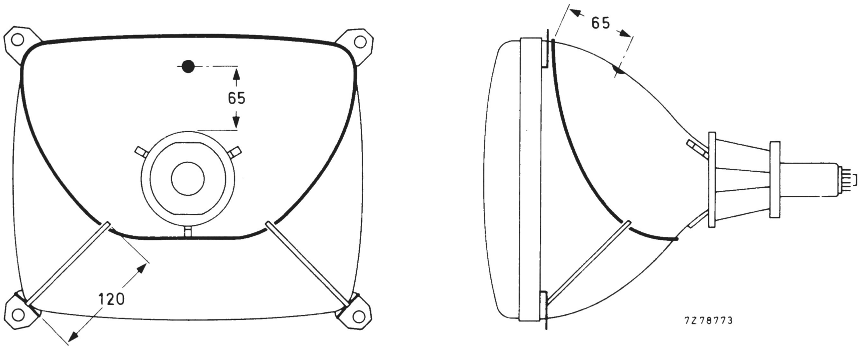


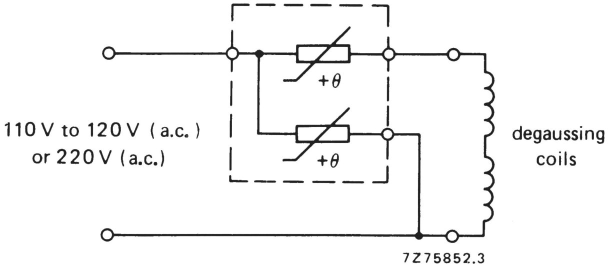
Fig. 13 Position of degaussing coil on the display tube; dimensions are given in mm.

For proper degaussing an initial magnetomotive force (m.m.f.) of 600 ampere-turns is required in the coil. This m.m.f. has to be gradually decreased. In the steady state, no significant m.m.f. should remain in the coil (⩽ 0,6 ampere-turns).

If single-phase power rectification is used, provision should be included to prevent asymmetric distortion of the a.c. voltage applied to the degaussing circuit due to high d.c. inrush currents.

An example of a degaussing circuit and coil data for various mains voltage are given below.

Fig. 14
Degaussing circuit using dual PTC thermistor.



Data of degaussing coil

	110 to 120 V (a.c.)	220 V (a.c.)
Circumference	90 cm	90 cm
Number of turns	70	120
Copper-wire diameter	0,45 mm	0,3 mm
Resistance	6,7 Ω	25,9 Ω
Catalogue number of dual PTC thermistor	8222 298 73091	2322 662 98009

MOUNTING OF NECK COMPONENTS

The relative position of the deflection unit AT1331 and the magnets for static convergence and the purity magnet, on the neck of the display tube is shown in Fig. 15. For mounting of these components, see the relevant data sheet.

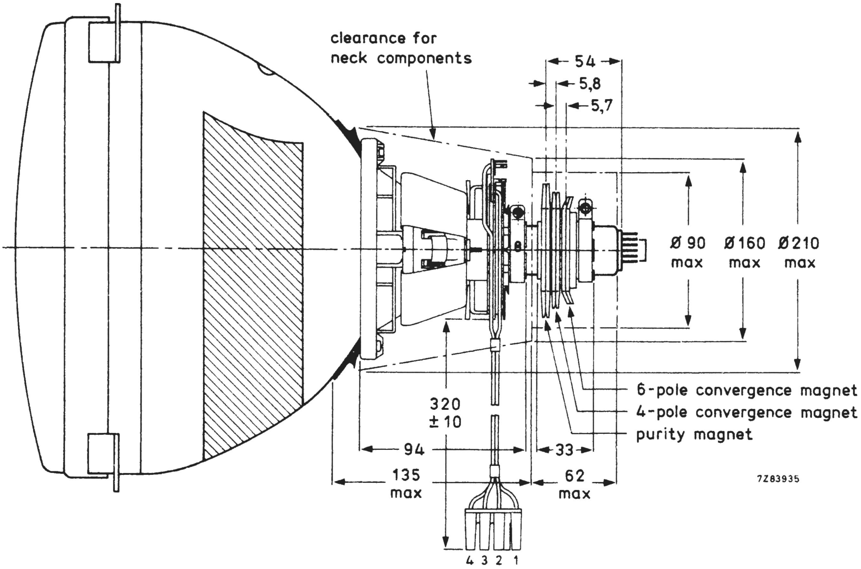

clearance for
neck components
54
5,8
5,7
Ø 90 max
Ø160 max
Ø210 max
6-pole convergence magnet
4-pole convergence magnet
purity magnet
320 ± 10
94
33
135 max
62 max
7Z83935
4 3 2 1

Fig. 15 Relative placement of neck components on the display tube.

HIGH RESOLUTION COLOUR DISPLAY TUBE ASSEMBLIES

- To be read in conjunction with data sheets for the high resolution colour display tube M37-102X and deflection units AT1331 series.

PERFORMANCE SPECIFICATION

These display tube assemblies consist of the high resolution colour display tube M37-102X, a deflection unit from the AT1331 series, and a static convergence/colour purity device. The assemblies form a pre-aligned self-converging system that does not require adjustment of dynamic convergence.
A four-pin plug is provided for electrical connection to the deflection unit.
Four types of tube assemblies are available, as shown in Table 1.

Table 1

assembly type	assembly components
M37-102X/3100	tube M37-102X + deflection unit AT1331/00 + static convergence/purity device
M37-102X/3110	tube M37-102X + deflection unit AT1331/10 + static convergence/purity device
M37-102X/3120	tube M37-102X + deflection unit AT1331/20 + static convergence/purity device
M37-102X/3130	tube M37-102X + deflection unit AT1331/30 + static convergence/purity device

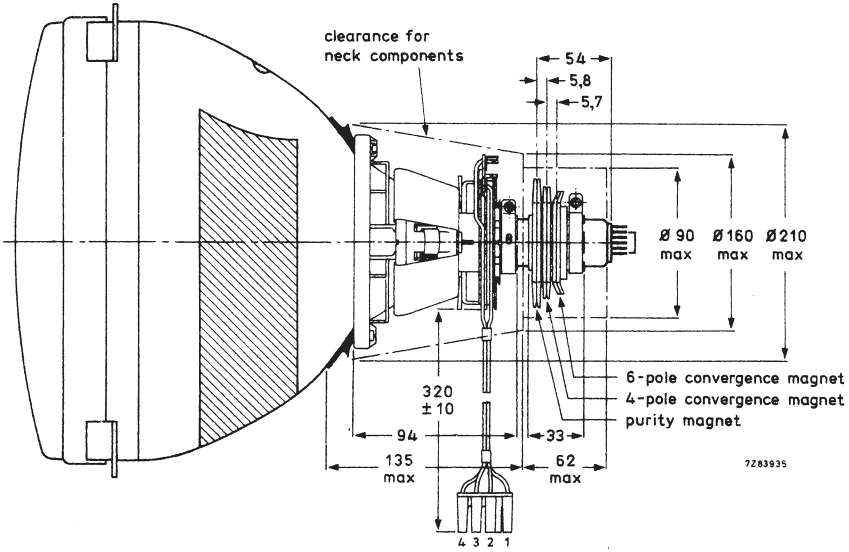

clearance for neck components
54
5,8
5,7
Ø 90 max
Ø 160 max
Ø 210 max
6-pole convergence magnet
4-pole convergence magnet
purity magnet
320 ± 10
94
33
135 max
62 max
4 3 2 1
7Z83935

Fig. 1.

CONVERGENCE AND RASTER SPECIFICATION

The maximum misconvergence after 15 min operation is given in Table 2 and Fig. 2.

Test conditions (all voltages are measured with respect to grid 1)

Heater voltage	V_f	6,3 V
Grid 2 voltage	V_{g2}	360 V
Grid 3 voltage	V_{g3}	to be adjusted for focus at screen centre, using cross-hatch pattern or characters H, at anode current of 300 μA (peak) per gun
Anode voltage	V_a	25 kV
Test pattern		cross-hatch pattern
Ambient temperature	T_{amb}	25 ± 5 °C
Ambient magnetic field		all measurements should be done in a magnetic field of which the vertical component is adjusted to the typical terrestrial magnetism in the final destination market, and the horizontal component neutralized.

Remarks

1. Misconvergence is the distance between centres of the red, green, blue lines at the screen using rectangular co-ordinates.
2. Anode and/or focusing voltage and terrestrial magnetism affect the static convergence performance. Therefore small readjustments of the static convergence magnets may become necessary.

Table 2 Maximum misconvergence after 15 min operation

location (see Fig. 2)	type of error	max. error between any colour
A	red-green-blue line separation in either the horizontal or vertical direction	0,3 mm
B,C,D,E		0,7 mm
F,G,H,I		0,7 mm
K,L,M,N		0,7 mm

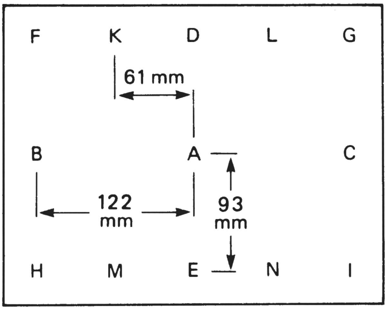


Fig. 2 Convergence test areas. Diameter of test circles at measuring points = 25 mm.

Raster centring	
horizontal	max. 6 mm
vertical	max. 4 mm
Raster rotation	max. 1,2 mm (see Fig. 3)

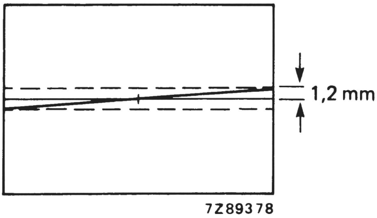


Fig. 3 Raster rotation.

Total pattern distortion, measured without east-west and north-south correction

East-west pattern distortion (see Fig. 4)	max. 4,5%
North-south pattern distortion (see Fig. 5)	max. 2%

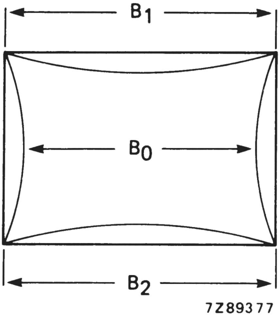


Fig. 4 East-west pattern distortion.

Definition: $\frac{\frac{1}{2}(B_1 + B_2) - B_0}{\frac{1}{2}(B_1 + B_2)} \times 100\%$,

where $B_1 = B_2 \approx 244$ mm.

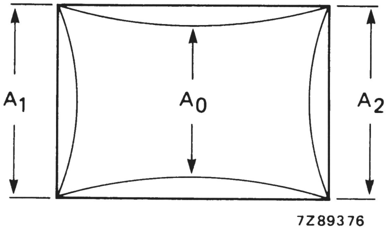


Fig. 5 North-south pattern distortion.

Definition: $\frac{\frac{1}{2}(A_1 + A_2) - A_0}{\frac{1}{2}(A_1 + A_2)} \times 100\%$,

where $A_1 = A_2 \approx 186$ mm.

DEVELOPMENT SAMPLE DATA

MONOCHROME MONITOR TUBES
FOR DATA GRAPHIC DISPLAY

SURVEY

face diagonal	type	deflection angle	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g4} V	V_{g2} V	remarks
24 cm (9 in)	M24-300 series	90°	20	227*	11/140	12	0-130	130	medium resolution
31 cm (12 in)	M31-320 series	110°	28,6	241*	6,3/240	17	0-400	400	high resolution
	M31-330 series	90°	20	280*	11/140	12	0-130	130	medium resolution
38 cm (15 in)	M38-320 series M38-330 series	110°	28,6	279*	6,3/240	17	0-400	400	high resolution

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

MONITOR TUBES

- 90° deflection angle
- 24 cm (9 in) face diagonal; rectangular glass
- 20 mm neck diameter
- white or green phosphor
- integral protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	24 cm (9 in)
Overall length	max. 227 mm*
Neck diameter	20 mm
Heating	11 V/140 mA
Grid 2 voltage	130 V
Anode voltage	12 kV
Quick-heating cathode	with a typical tube a legible picture will appear within 5s

APPLICATION

These monitor tubes are used for information display and data terminals, e.g. in video monitoring equipment, computer terminals, word processors.

The tubes are supplied with different screen phosphors: white (W) or green (GH and GR). They are available with anti-reflective bonded face-plate.

The tubes can be supplied with additional deflection unit.

AVAILABLE VERSIONS

	versions without earthing strip	versions with earthing strip
monitor tubes without anti-reflective face-plate without lugs	M24 - 300W M24 - 300GH M24 - 300GR	M24 - 304W M24 - 304GH M24 - 304GR
monitor tubes with anti-reflective face-plate without lugs		M24 - 305W M24 - 305GH M24 - 305GR
monitor tubes without anti-reflective face-plate with lugs	M24 - 302W M24 - 302GH M24 - 302GR	
monitor tubes with anti-reflective face-plate with lugs	M24 - 303W M24 - 303GH M24 - 303GR	

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 82°
vertical	approx. 67°
Direct interelectrode capacitances	
cathode to all other electrodes	approx. 3 pF
grid 1 to all other electrodes	approx. 7 pF
External conductive coating to anode	max. 750 pF min. 300 pF
Heater voltage	11 V
Heater current at 11 V	140 mA

OPTICAL DATA

Phosphor number	W, GH and GR (P4, P31 and P39 respectively, according to JEDEC)
Light transmission at centre	
of screen	approx. 53%
of screen with anti-reflective face-plate	approx. 32%

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis is adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line is 47 mm.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 227 mm *
Greatest dimensions of tube	
diagonal	247 mm
width	216 mm
height	167 mm
Minimum useful screen dimensions (projected)	
diagonal	228 mm
horizontal axis	198 mm
vertical axis	149 mm
area	285 cm^2
Recommended useful screen dimensions for alpha-numeric display	
diagonal	210 mm
horizontal axis	168 mm
vertical axis	126 mm
Implosion protection	T-band and/or anti-reflective face-plate
Bulb	EIA-J240A1
Bulb contact designation	IEC67-III-2; JEDEC J1-21
Base designation	JEDEC E7-91
Basing	7GR
Mass, without anti-reflective face-plate	approx. 1,8 kg

RATINGS (Absolute Maximum System); cathode drive

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max.	15	kV
	min.	9	kV
Grid 4 (focusing electrode) voltage	−200 to	+ 1000	V
Grid 2 voltage	max.	200	V **
Cathode voltage			
negative bias value	max.	0	V
negative peak value	max.	2	V
positive bias value	max.	200	V
positive peak value	max.	400	V
Heater voltage	max.	12,7	V ***
	min.	9,3	V ***
Cathode-to-heater voltage	max.	200	V

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

** For alpha-numeric display, i.e. low beam current ($<$ 200 μA), improved sharpness can be obtained by increasing grid 2 voltage to max. 400 V.

*** For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS; cathode drive

Voltages are specified with respect to grid 1.

→ Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 130 V
Grid 2 voltage	130 V *
Cathode cut-off voltage	45 to 65 V **

X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings. See curves on the opposite page.

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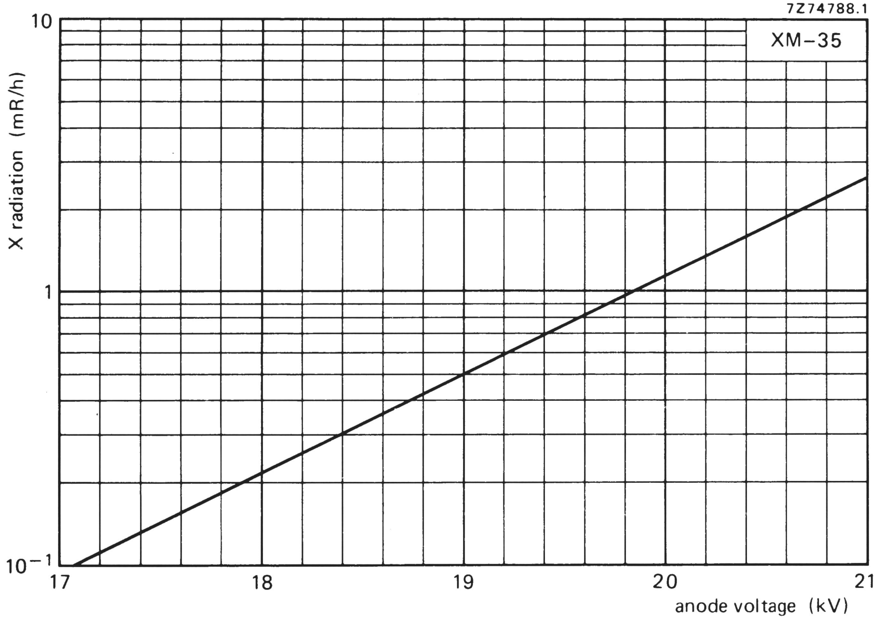
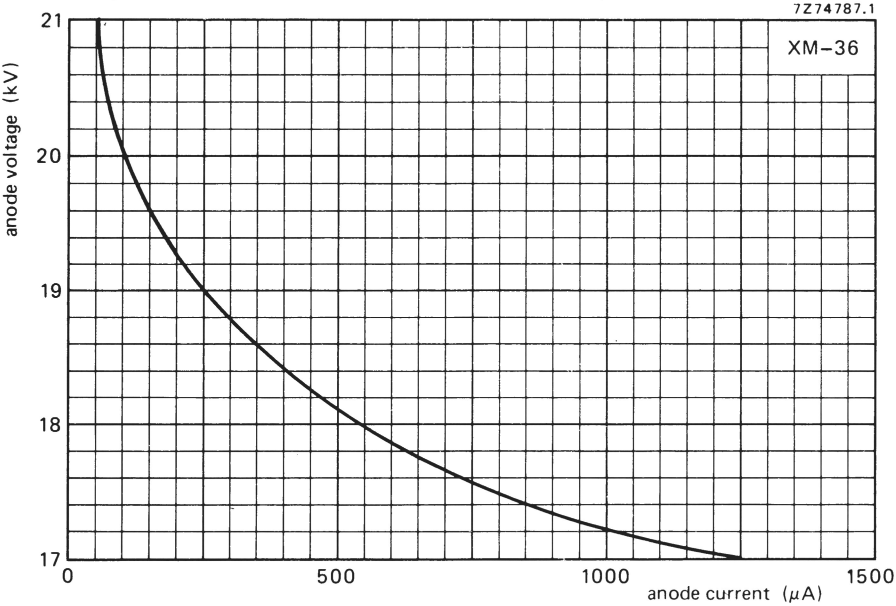
* For alpha-numeric display, i.e. low beam current (< 200 μA), improved sharpness can be obtained by increasing grid 2 voltage to max. 400 V.

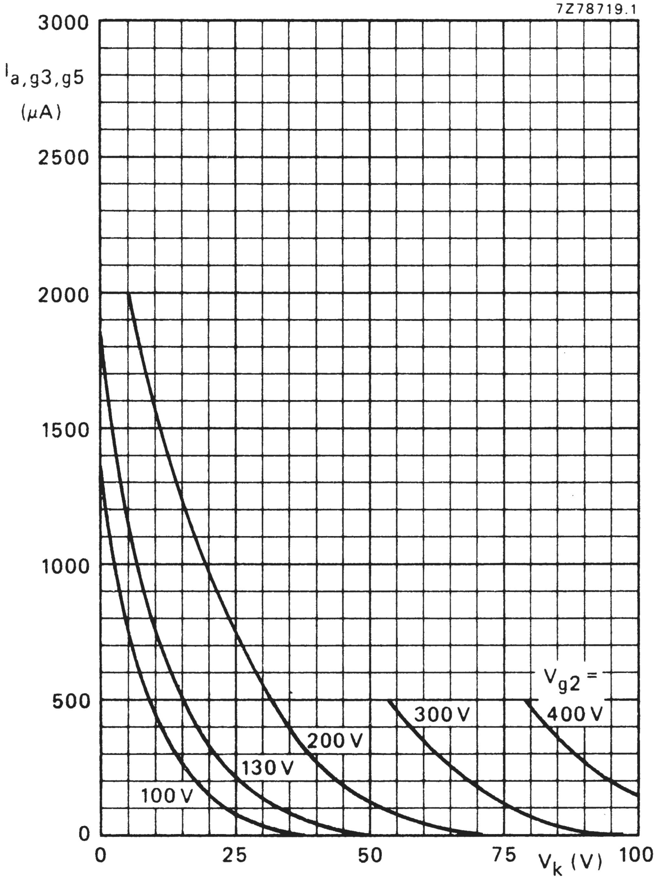
** Visual extinction of focused raster.



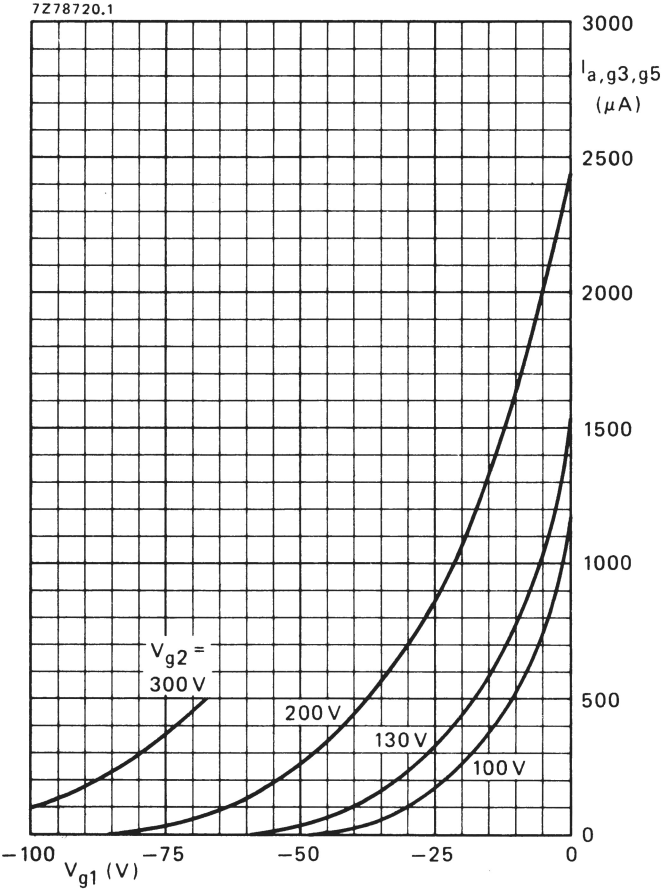
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to JEDEC64D.



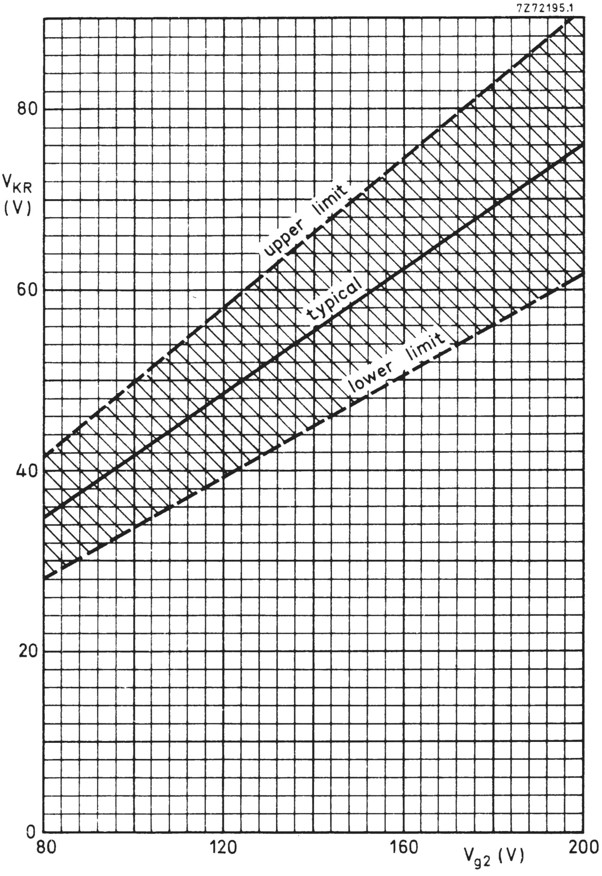
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to JEDEC64D.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

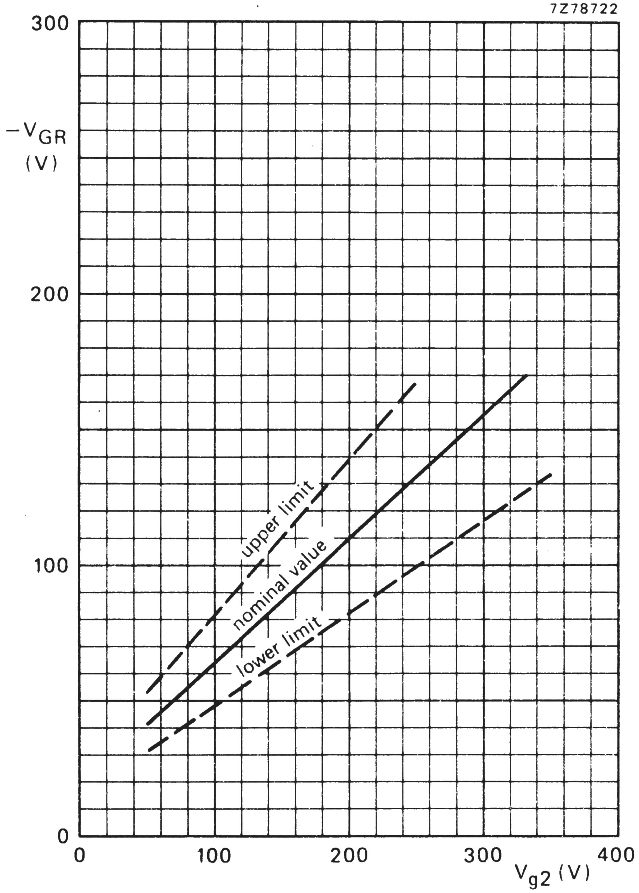


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



→ Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}3 \times 10^{-3}$$

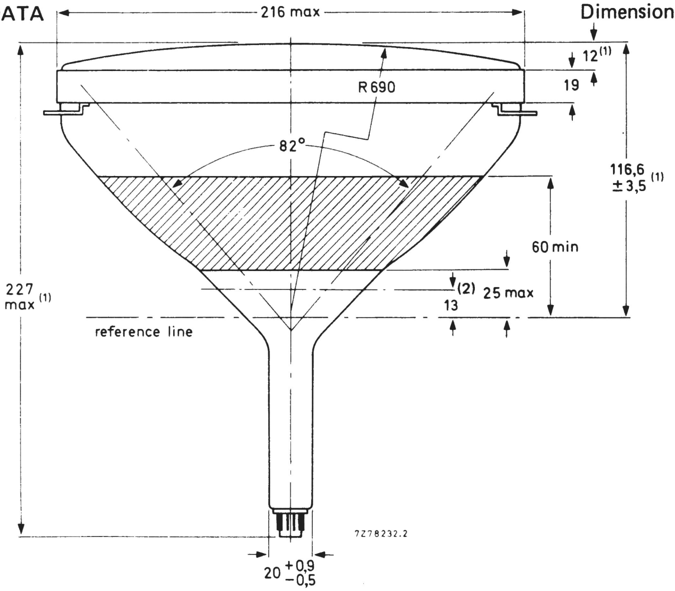


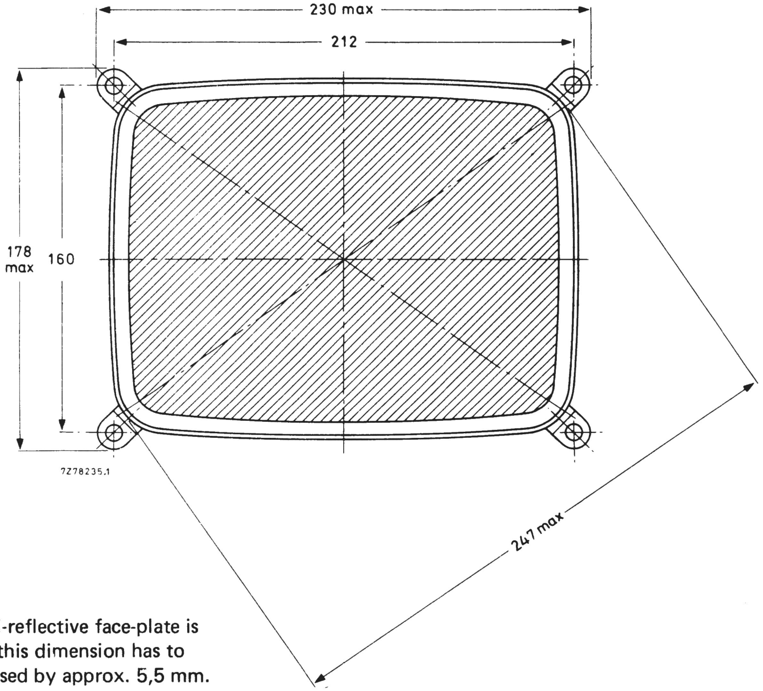
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

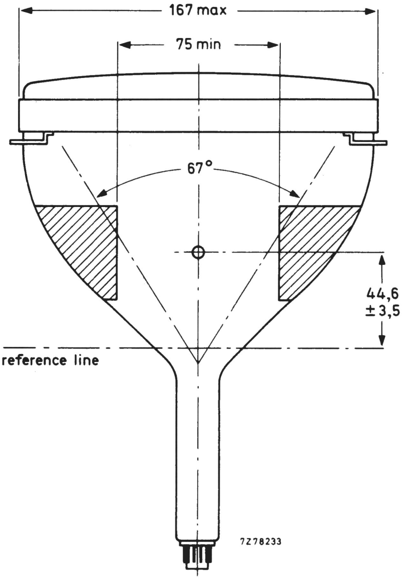
DIMENSIONAL DATA

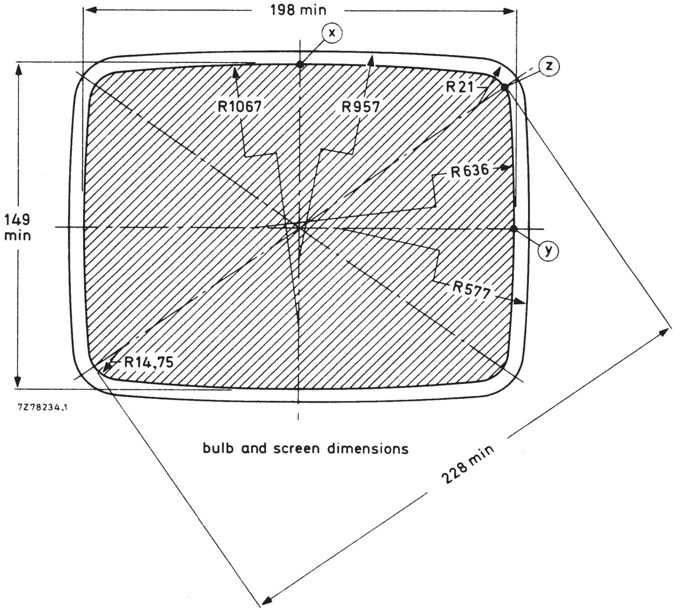
Dimensions in mm


216 max
12 (1)
19
R690
82°
116,6 (1)
± 3,5
60 min
(2) 25 max
13
227 max (1)
reference line
7Z78232.2
20 +0,9 −0,5

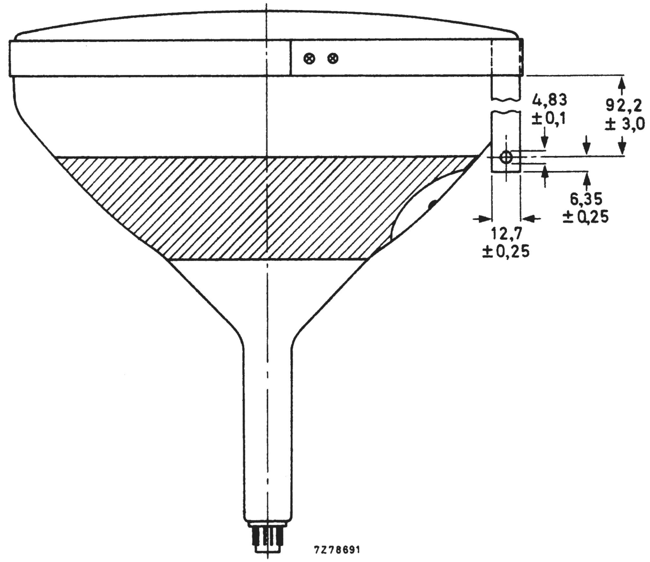

230 max
212
178 max
160
7Z78235.1
247 max

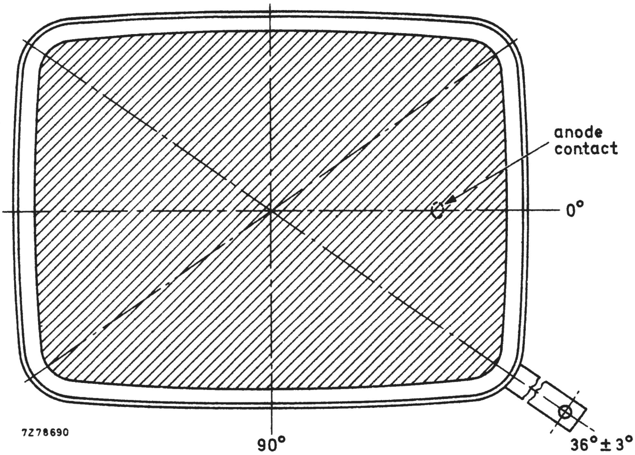
(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.
(2) End of guaranteed contour.


167 max
75 min
67°
44,6
±3,5
reference line
7Z78233

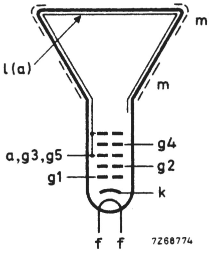

198 min
x
z
y
R21
R1067
R957
R636
R577
R14,75
149
min
228 min
7Z78234.1

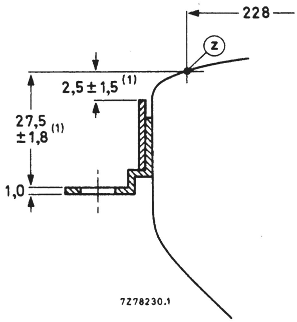
bulb and screen dimensions

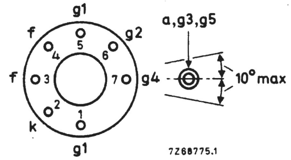

4,83
±0,1
92,2
± 3,0
6,35
±0,25
12,7
±0,25
7Z78691

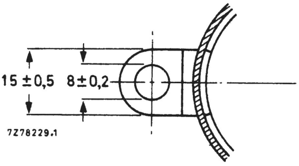

anode
contact
0°
90°
36° ± 3°
7Z78690

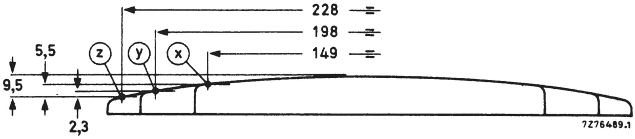
Version with earthing strip. (M24-304 and M24-305). Dimensions are identical with those in the figures on the preceding pages, except as shown.

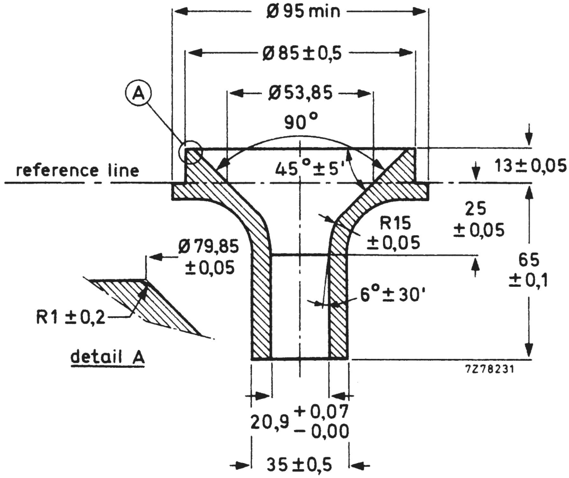

m'
l(a)
m
g4
a,g3,g5
g2
g1
k
f f
7Z68774


228
z
2,5 ± 1,5 (1)
27,5 ± 1,8 (1)
1,0
7Z78230.1


g1
f
g2
a,g3,g5
4
5
6
f
3
7
g4
10° max
2
1
k
g1
7Z68775.1


15 ± 0,5
8 ± 0,2
7Z78229.1


228
198
149
5,5
z
y
x
9,5
2,3
7Z76489.1

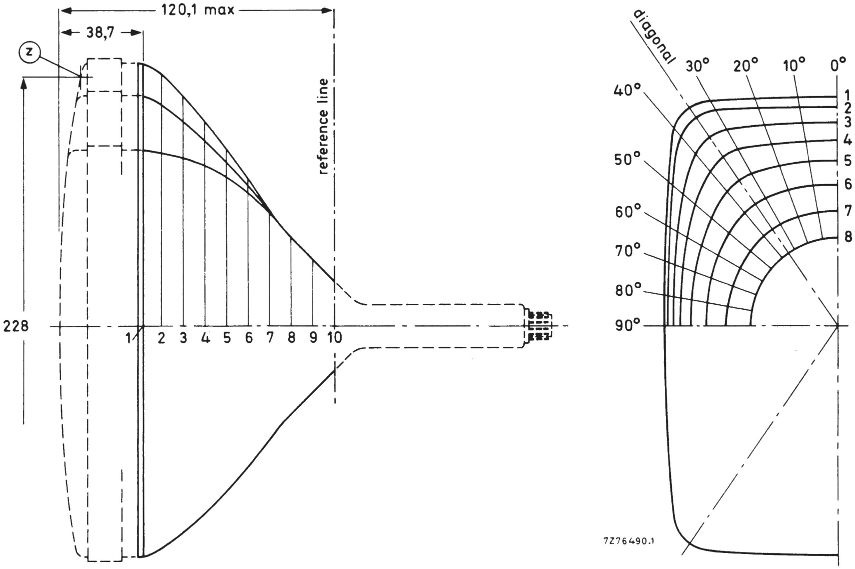

Ø 95 min
Ø 85 ± 0,5
A
Ø 53,85
90°
reference line
45° ± 5'
13 ± 0,05
25 ± 0,05
R15 ± 0,05
Ø 79,85 ± 0,05
65 ± 0,1
6° ± 30'
R1 ± 0,2
detail A
7Z78231
20,9 +0,07 −0,00
35 ± 0,5

Reference line gauge.

---

(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

Maximum cone contour


120,1 max
38,7
z
reference line
228
1
2
3
4
5
6
7
8
9
10
diagonal
30°
20°
10°
0°
1
2
3
4
5
6
7
8
40°
50°
60°
70°
80°
90°
7Z76490.1

Section	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
10	87,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5
9	77,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5
8	67,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
7	57,5	52,8	52,9	53,1	53,5	53,6	53,4	53,0	52,5	52,1	51,9	52,0
6	47,5	64,8	65,2	66,4	67,8	67,9	67,7	66,2	64,0	62,4	61,5	61,2
5	37,5	75,5	76,2	78,1	80,8	81,2	80,7	77,4	73,2	70,3	68,6	68,1
4	27,5	85,0	86,0	88,8	93,6	93,6	92,7	86,6	80,4	76,3	73,9	73,2
3	17,5	93,6	94,7	98,1	104,1	105,3	103,7	93,7	85,8	80,6	77,7	76,9
2	7,5	101,3	102,7	106,9	114,4	116,3	113,8	99,7	89,9	83,6	80,3	79,3
1	0	104,7	106,2	110,3	117,9	120,0	117,2	102,0	91,4	84,8	81,2	80,3

HIGH RESOLUTION CRTs FOR DATA DISPLAY

- 110° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- white or green screen phosphor
- integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	31 cm (12 in)
Overall length	max. 241 mm*
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

These high resolution CRTs are intended for alpha-numeric and graphic display applications, such as computer terminals, word processors, etc.

The CRTs can be supplied with white (W) or green (GH and GR) phosphors and with or without anti-reflective bonded face-plate.

AVAILABLE VERSIONS

CRTs without anti-reflective face-plate with lugs	M31-326W M31-326GH M31-326GR
CRTs with anti-reflective face-plate with lugs	M31-325W M31-325GH M31-325GR

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 110°
horizontal	approx. 98°
vertical	approx. 81°
Direct interelectrode capacitances	
cathode to all other electrodes	approx. 3 pF
grid 1 to all other electrodes	approx. 7 pF
Capacitance of external conductive coating to anode*	max. 900 pF min. 450 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	W, GH and GR (P4, P31 and P39 respectively, according to EIA)
Light transmission at centre	
of screen	approx. 50%
of screen with anti-reflective face-plate	approx. 30%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

---

* Implosion protection hardware is connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 241 mm*
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	501 cm^2
Implosion protection	T-band and/or anti-reflective face-plate
Bulb	J99A1
Bulb contact designation	IEC 67-III-2, EIA J1-21
Base designation	IEC 67-I-31a; EIA B7-208
Basing	8HR
Mass, without anti-reflective face-plate	approx. 2,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 19 kV min. 13 kV
Grid 4 (focusing electrode) voltage	–500 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%
Cathode-to-heater voltage	max. 100 V

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-reflective face-plate, raster dimensions 216 mm x 162 mm.

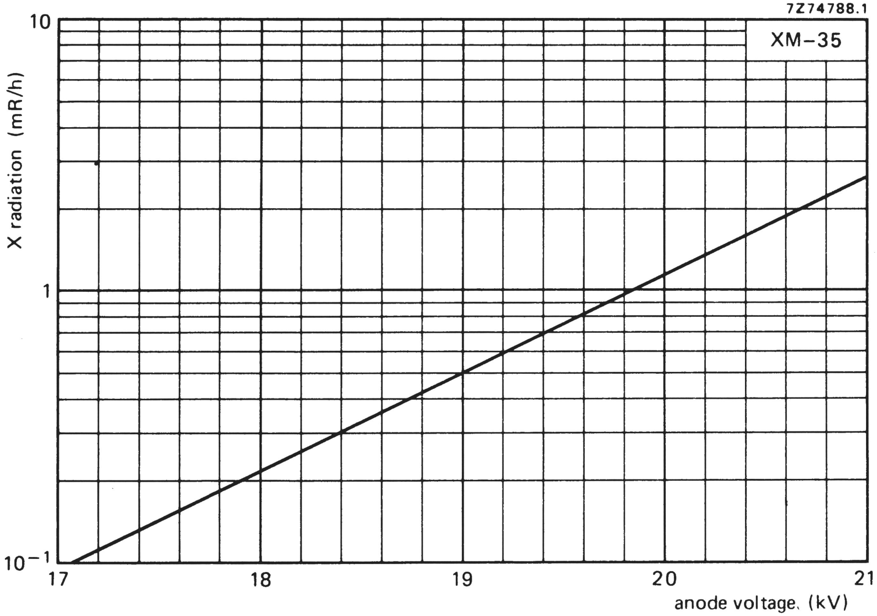
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

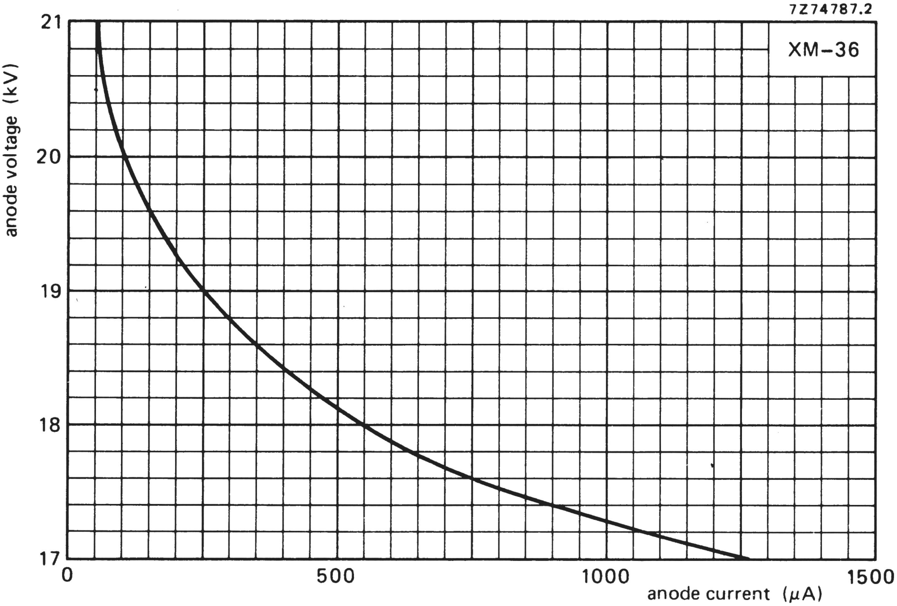
---

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V. For optimum overall sharpness dynamic focusing is recommended (typ. 250 V).

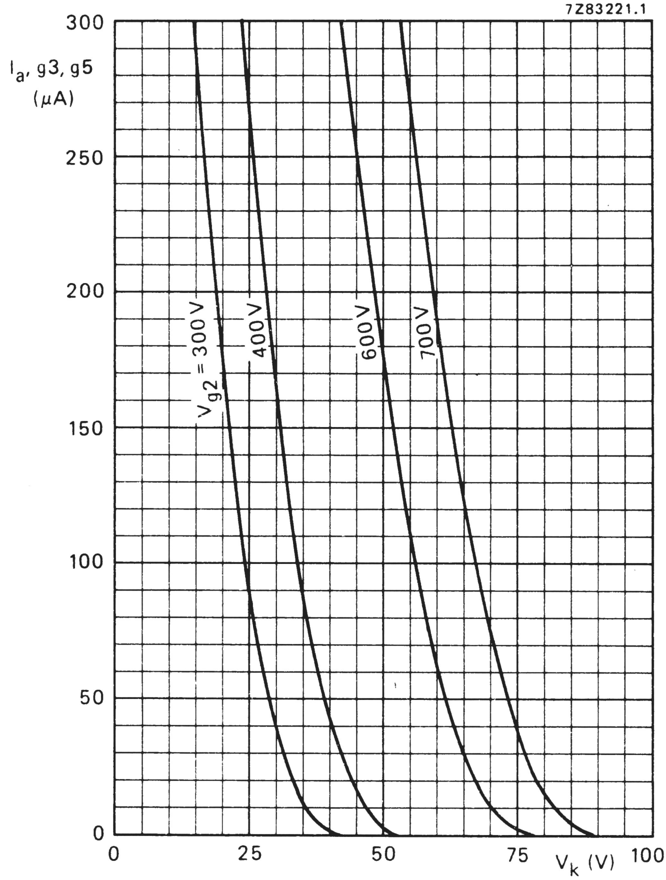
** Visual extinction of focused raster.



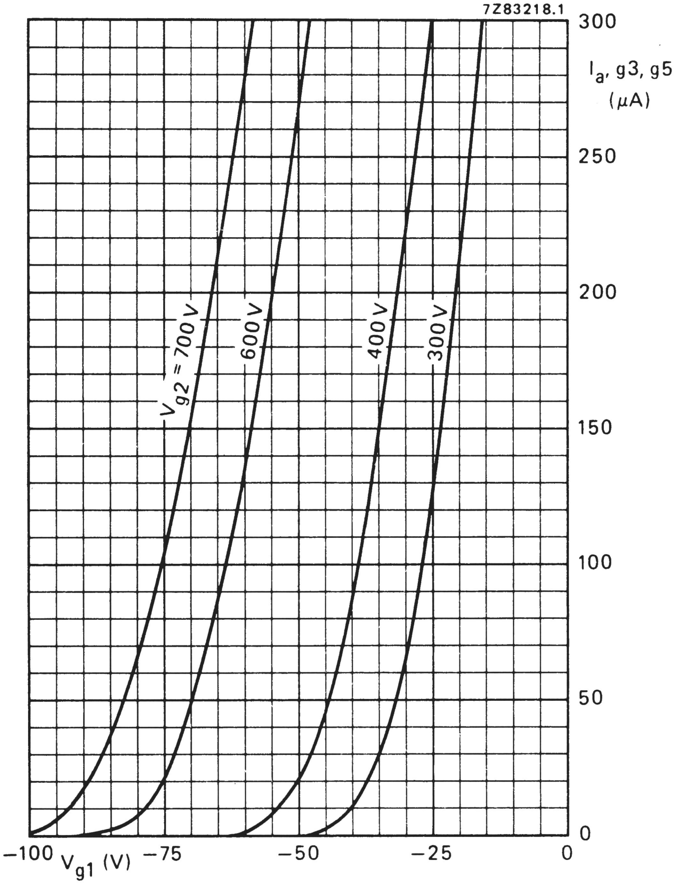
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to JEDEC64D.



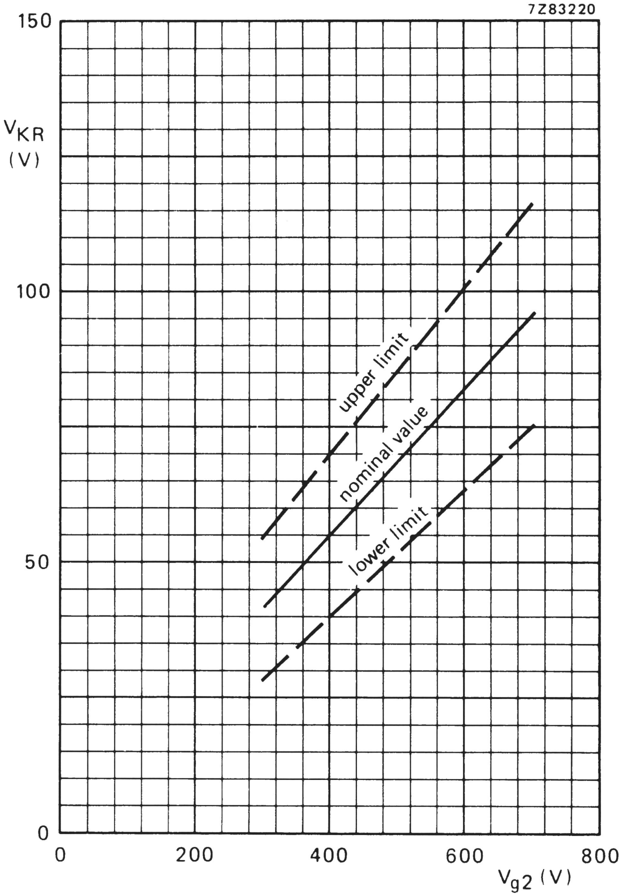
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to JEDEC 64D.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

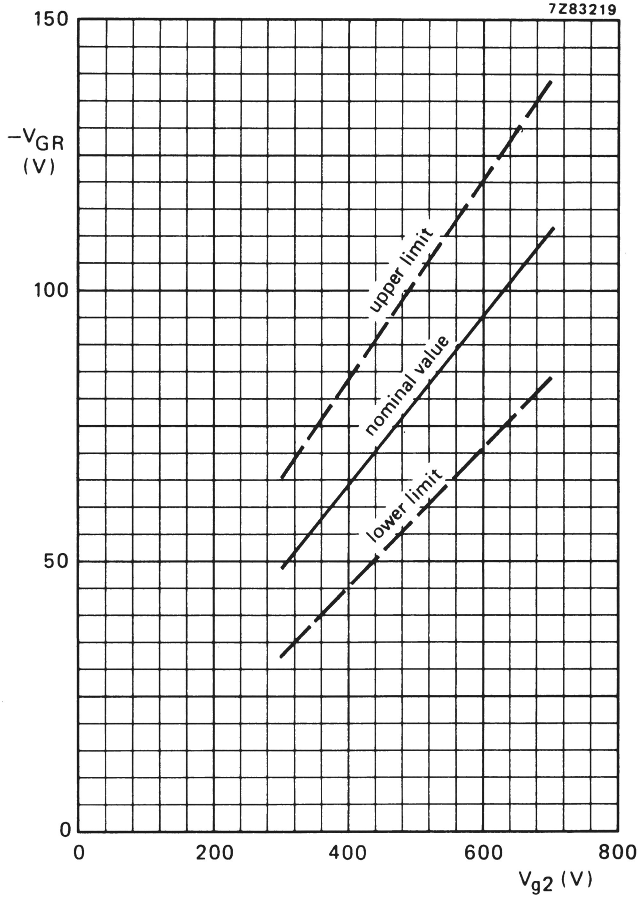


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

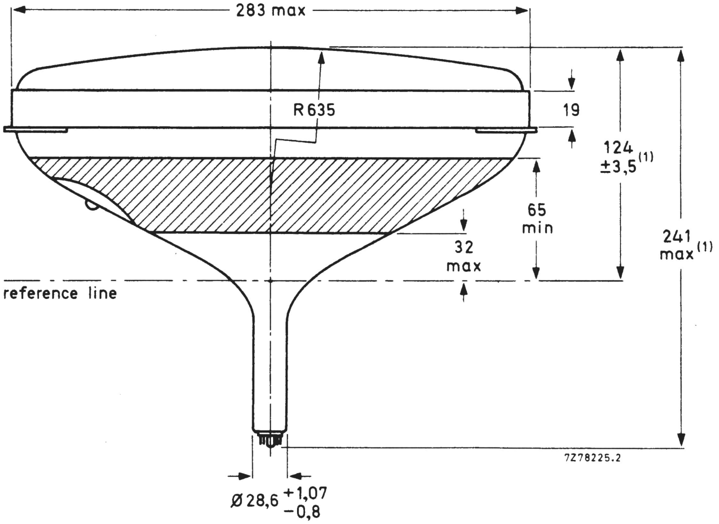


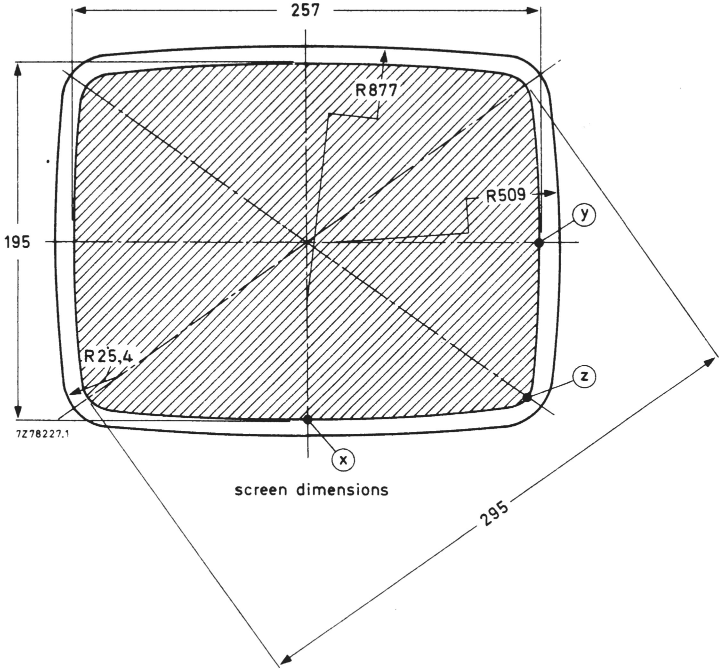
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

DIMENSIONAL DATA

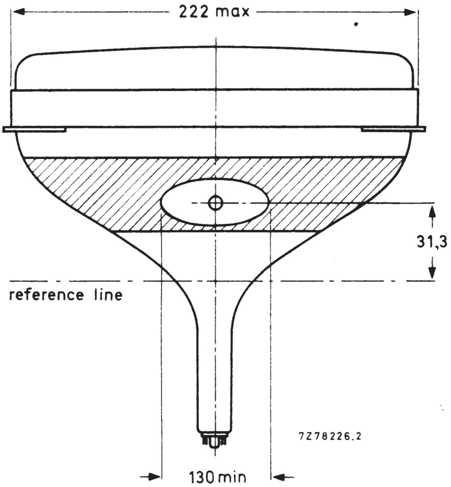
Dimensions in mm

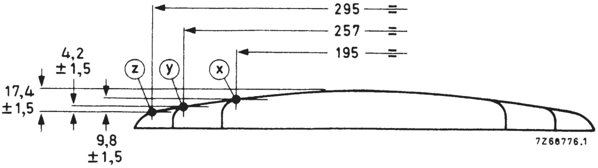

283 max
R635
19
124
±3,5 (1)
65
min
32
max
241
max (1)
reference line
7Z78225.2
Ø28,6 +1,07 −0,8

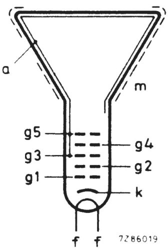

257
R877
R509
y
195
R25,4
z
x
7Z78227.1
295

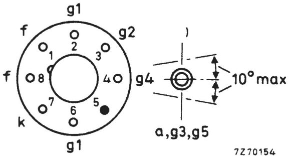
screen dimensions

(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

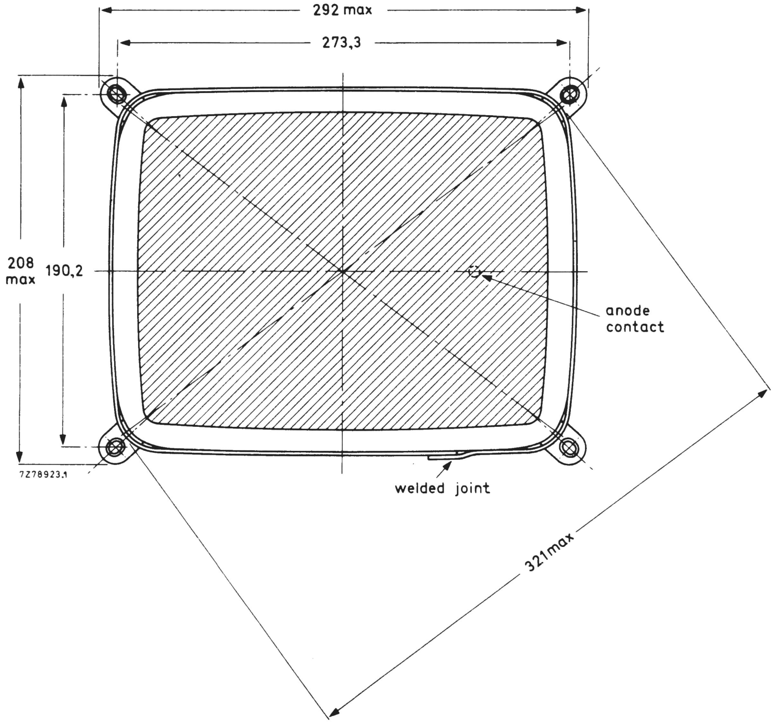

222 max
31,3
reference line
7Z78226.2
130 min

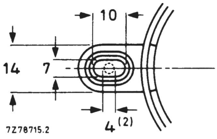

295
257
195
4,2
±1,5
17,4
±1,5
9,8
±1,5
z
y
x
7Z68776.1

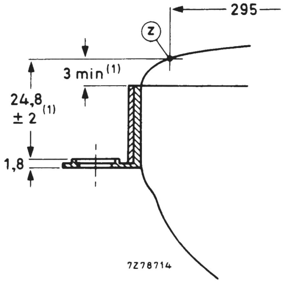

a
m
g5
g3
g1
g4
g2
k
f
f
7Z86019


g1
f
g2
1
2
3
f
8
4
g4
7
6
5
k
g1
10° max
a,g3,g5
7Z70154

Front view and lug dimensions of tubes M31-325 and M31-326


292 max
273,3
208 max
190,2
anode contact
welded joint
321 max
7Z78923.1

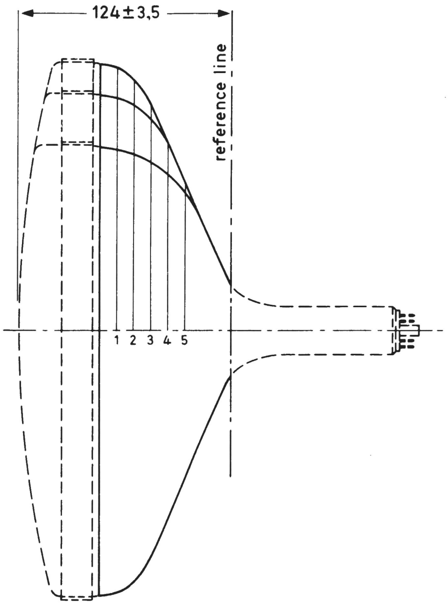

10
14
7
4 (2)
7Z78715.2

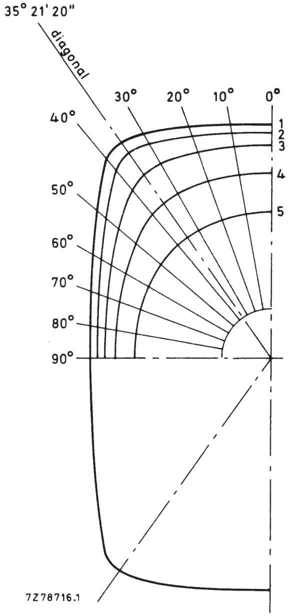

295
z
3 min (1)
24,8 ± 2 (1)
1,8
7Z78714

(1) For M31-325 (with anti-reflective face-plate), this dimension has to be increased by approx. 5,5 mm.

(2) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour


124 ± 3,5
reference line
1
2
3
4
5


35° 21' 20"
diagonal
30°
20°
10°
0°
40°
50°
60°
70°
80°
90°
1
2
3
4
5
7Z78716.1

Section	Nom. distance from reference line	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	68,3	137,2	138,7	143,4	151,8	155,4	152,5	133,8	120,8	112,6	108,2	106,8
2	58,3	133,0	134,2	138,3	145,8	148,2	142,2	126,6	115,2	108,0	104,1	103,1
3	48,3	125,0	125,8	128,4	131,9	131,9	128,5	117,4	108,5	102,8	99,8	99,1
4	38,3	108,9	109,0	110,4	111,4	111,2	110,0	104,4	98,9	95,4	93,0	92,8
5	28,3	86,8	86,1	86,0	86,6	86,7	86,5	85,1	83,7	82,6	81,8	81,7

MONITOR TUBES

- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 20 mm neck diameter
- white or green phosphor
- integral protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 280 mm*
Neck diameter	20 mm
Heating	11 V/140 mA
Grid 2 voltage	130 V
Anode voltage	12 kV ←
Quick-heating cathode	with a typical tube a legible picture will appear within 5s

APPLICATION

These monitor tubes are used for information display and data terminals, e.g. in video monitoring equipment, computer terminals, word processors.

The tubes are supplied with different screen phosphors: white (W) or green (GH or GR). They are available with anti-reflective bonded face-plate.

The tubes can be supplied with additional deflection unit.

AVAILABLE VERSIONS ←

monitor tubes without anti-reflective face-plate with lugs	M31 - 334W M31 - 334GH M31 - 334GR
monitor tubes with anti-reflective face-plate with lugs	M31 - 333W M31 - 333GH M31 - 333GR

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 83°
vertical	approx. 65°
Direct interelectrode capacitances	
cathode to all other electrodes	approx. 5 pF
grid 1 to all other electrodes	approx. 8 pF
External conductive coating to anode	max. 900 pF min. 450 pF
Heater voltage	11 V
Heater current at 11 V	140 mA

OPTICAL DATA

Phosphor number	W, GH and GR (P4, P31 and P39 respectively, according to JEDEC)
Light transmission at centre	
of screen	approx. 50%
of screen with anti-reflective face-plate	approx. 30%

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis is adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line is 47 mm.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 280 mm *
Greatest dimensions of tube	
diagonal	315 mm
width	279 mm
height	227 mm
Minimum useful screen dimensions (projected)	
diagonal	292 mm
horizontal axis	254 mm
vertical axis	201 mm
area	483 cm^2
Recommended useful screen dimensions for alpha-numeric display	
diagonal	270 mm
horizontal axis	216 mm
vertical axis	162 mm
Implosion protection	T-band and/or anti-reflective face-plate
Bulb	EIA-J97 3/4M
Bulb contact designation	IEC 67-III-2; JEDEC J1-21
Base designation	JEDEC E7-91
Basing	7GR
Mass, without anti-reflective face-plate	approx. 2,9 kg

RATINGS (Absolute Maximum System); cathode drive

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max.	15	kV ←
	min.	9	kV
Grid 4 (focusing electrode) voltage		−200 to + 1000	V
Grid 2 voltage	max.	200	V **
Cathode voltage			
negative bias value	max.	0	V
negative peak value	max.	2	V
positive bias value	max.	200	V
positive peak value	max.	400	V
Heater voltage	max.	12,7	V ***
	min.	9,3	V ***
Cathode-to-heater voltage	max.	200	V

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

** For alpha-numeric display, i.e. low beam current ($< 200\ \mu A$), improved sharpness can be obtained by increasing grid 2 voltage to max. 400 V.

*** For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS; cathode drive

Voltages are specified with respect to grid 1.

→ Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 130 V
Grid 2 voltage	130 V *
Cathode cut-off voltage	45 to 65 V **

X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings. See curves on the opposite page.

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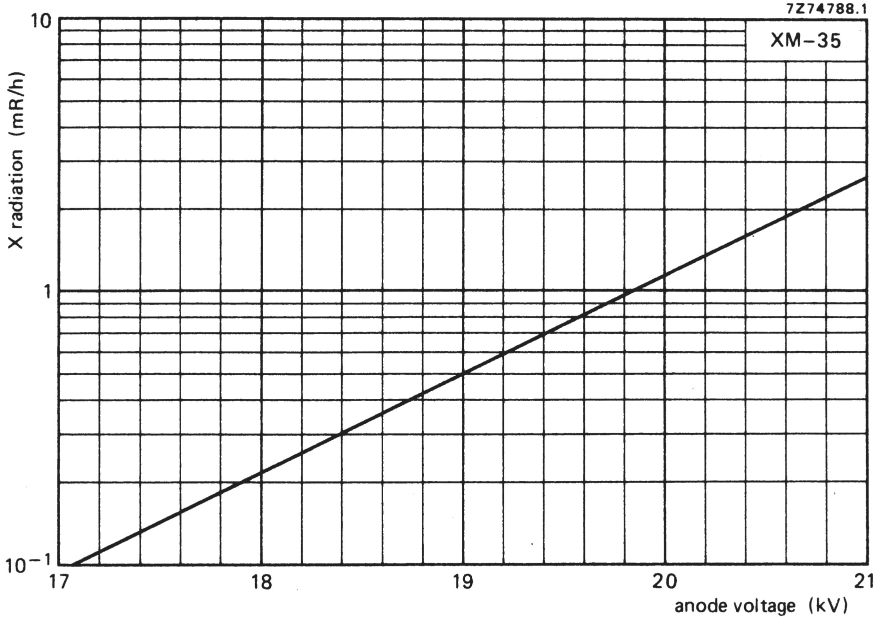
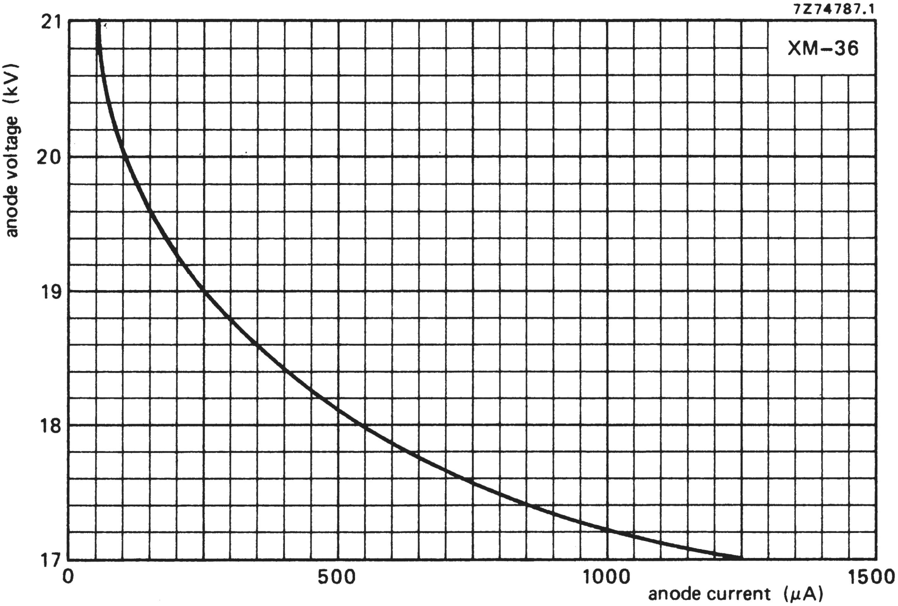
* For alpha-numeric display, i.e. low beam current (< 200 μA), improved sharpness can be obtained by increasing grid 2 voltage to max. 400 V.

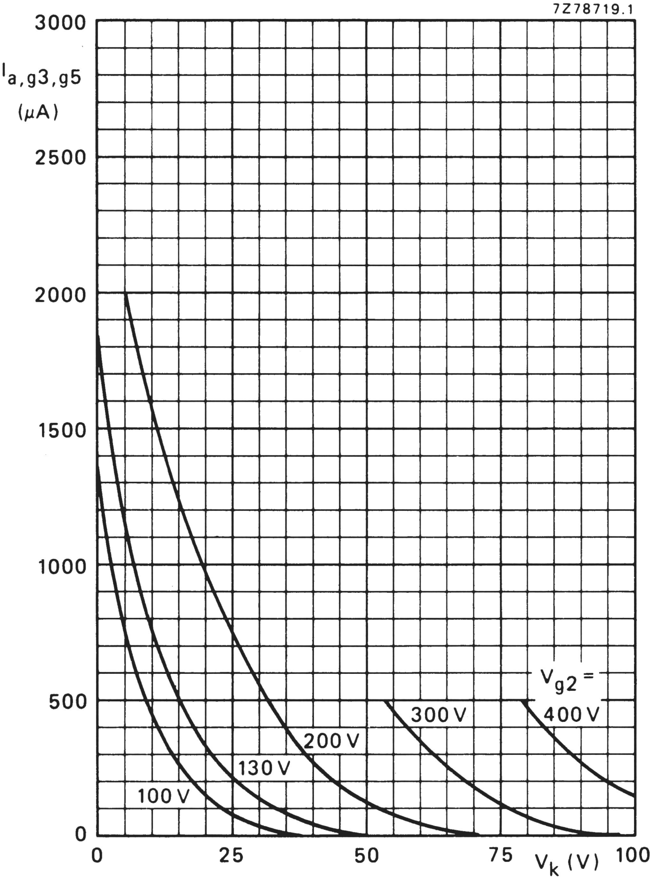
** Visual extinction of focused raster.



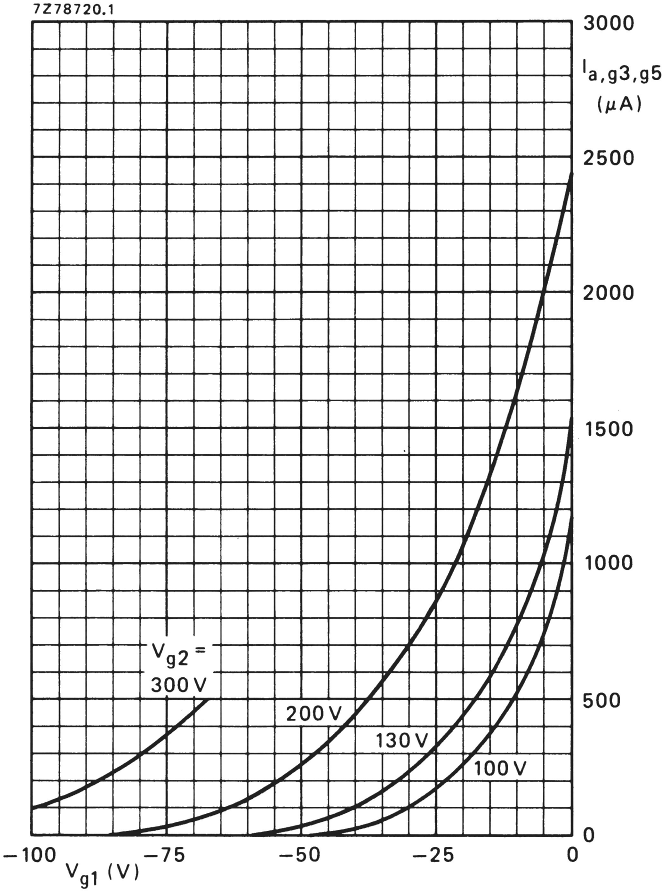
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to JEDEC64D.



0,5 mR/h isoexposure-rate limit-curve, according to JEDEC94, measured according to JEDEC64D.

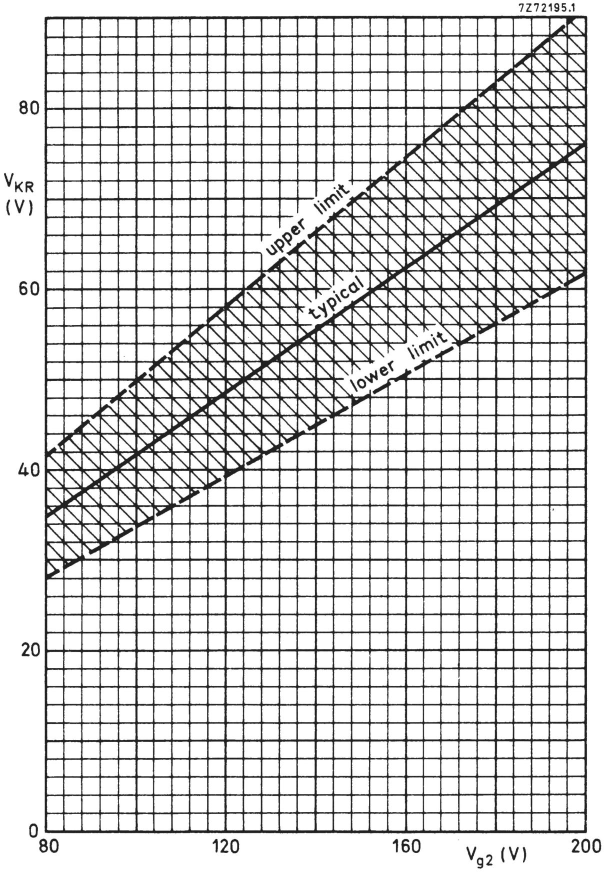


Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.



Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

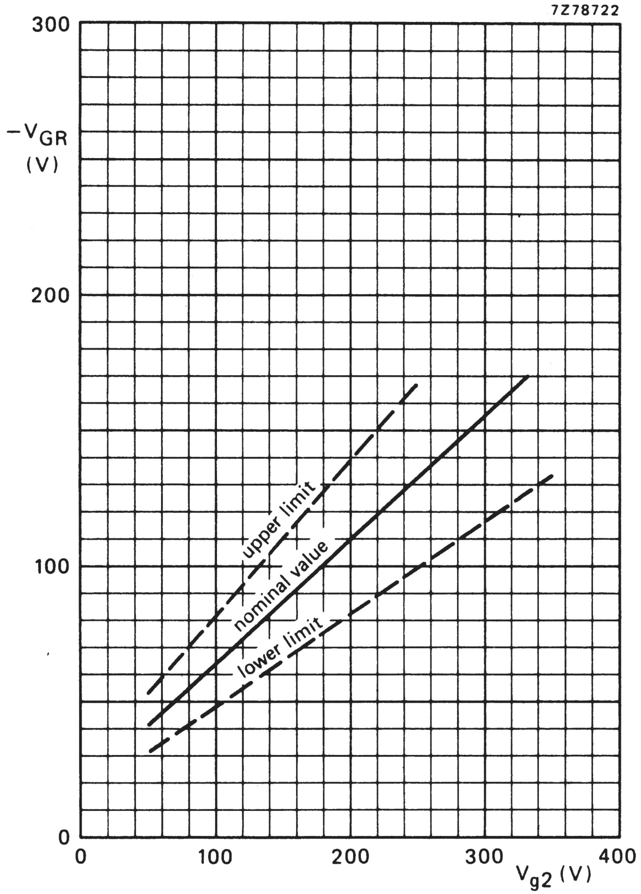
←



Limits of cathode cut-off voltage as a function of grid 2 voltage.

→ Cathode drive; $V_{a,g3,g5}$ = 12 kV.

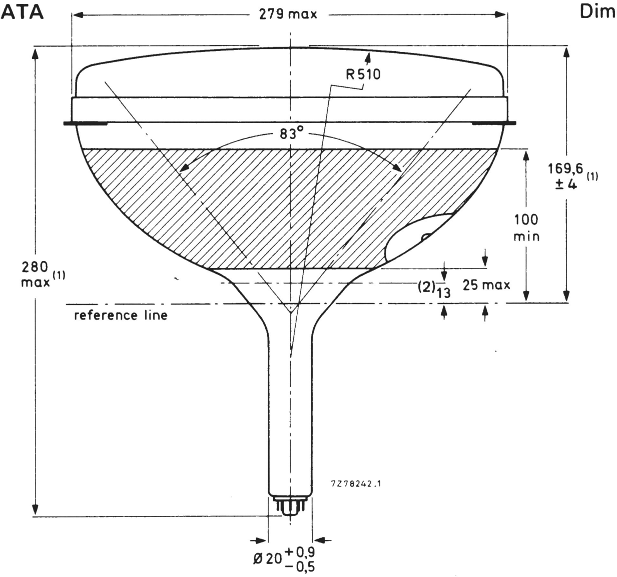
$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}3 \times 10^{-3}$$

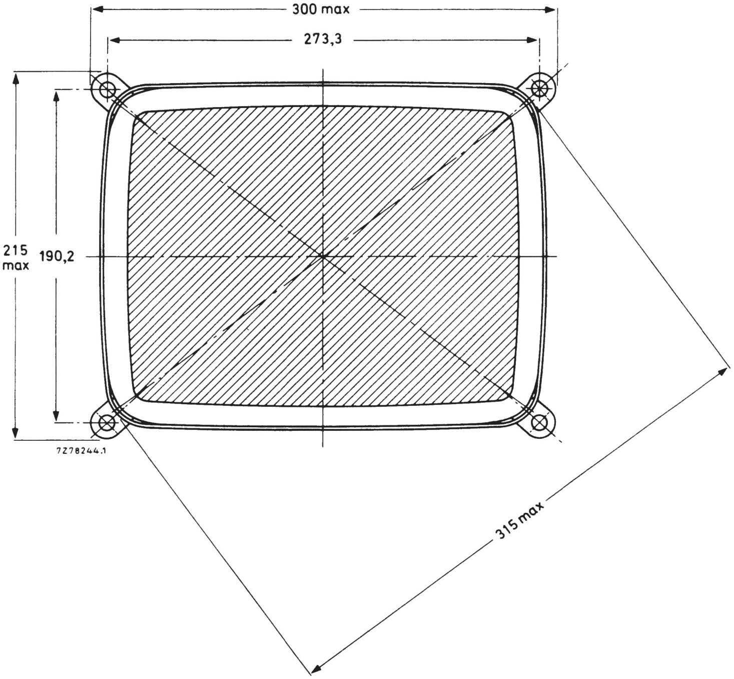


Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

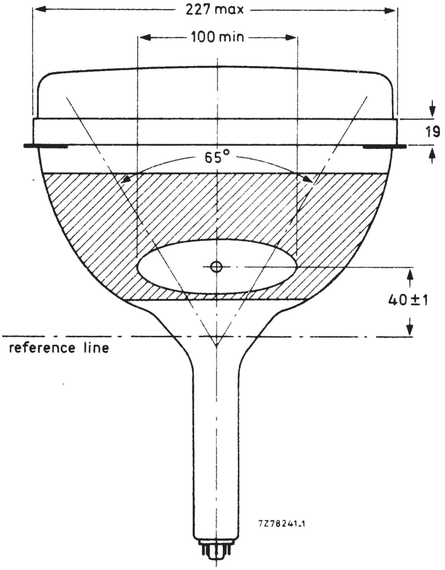
$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

DIMENSIONAL DATA Dimensions in mm

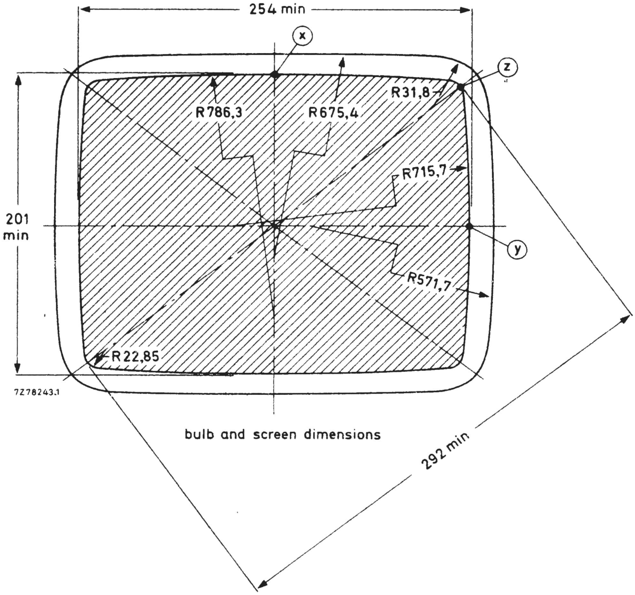

279 max
R510
83°
169,6 ± 4 (1)
100 min
280 max (1)
(2) 13
25 max
reference line
7Z78242.1
Ø 20 +0,9 −0,5


300 max
273,3
215 max
190,2
7Z78244.1
315 max

(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.
(2) End of guaranteed contour.

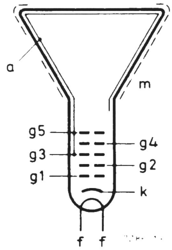

227 max
100 min
19
65°
40 ± 1
reference line

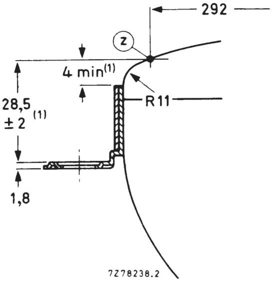
7Z78241.1

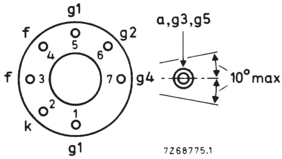

254 min
x
z
R786,3
R675,4
R31,8
R715,7
201 min
y
R571,7
R22,85
292 min

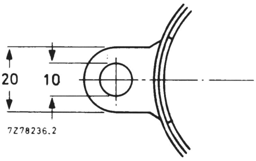
7Z78243.1

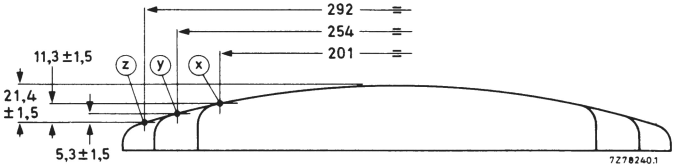
bulb and screen dimensions

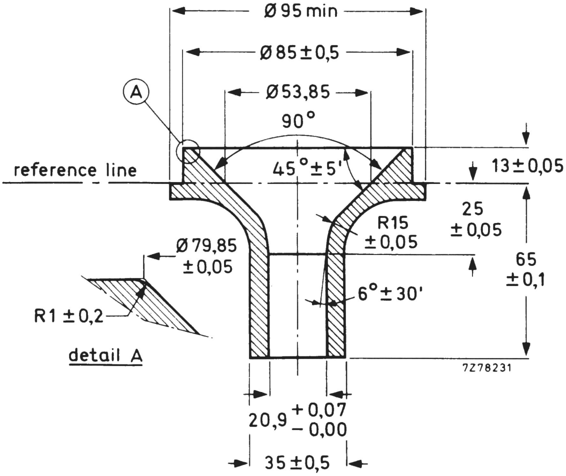

a
m
g5
g3
g1
g4
g2
k
f
f


292
z
4 min(1)
28,5 ± 2 (1)
R11
1,8
7Z78238.2


g1
f
g2
a,g3,g5
5
4
6
f
3
7
g4
10° max
2
1
k
g1
7Z68775.1


20
10
7Z78236.2


292
254
201
11,3 ± 1,5
z
y
x
21,4 ± 1,5
5,3 ± 1,5
7Z78240.1

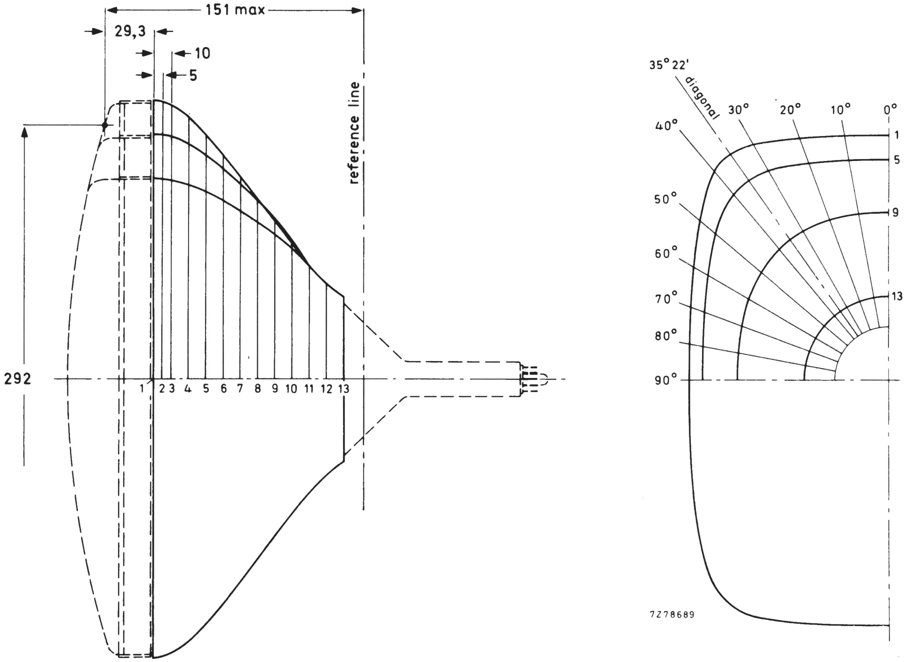

Ø 95 min
Ø 85 ± 0,5
Ø 53,85
A
90°
reference line
45° ± 5'
13 ± 0,05
25 ± 0,05
R15 ± 0,05
Ø 79,85 ± 0,05
65 ± 0,1
6° ± 30'
R1 ± 0,2
detail A
7Z78231
20,9 +0,07 −0,00
35 ± 0,5

Reference line gauge.

---

(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

Maximum cone contour


151 max
29,3
10
5
reference line
292
1
2
3
4
5
6
7
8
9
10
11
12
13
35° 22'
diagonal
30°
20°
10°
0°
40°
50°
60°
70°
80°
90°
1
5
9
13
7Z78689

Section	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
13	105,9	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4
12	99	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3
11	90	66,1	66,0	65,8	65,6	65,4	65,4	65,3	65,3	65,3	65,4	65,4
10	80	79,7	79,5	79,0	78,4	78,1	77,8	77,3	76,9	76,6	76,5	76,4
9	70	91,8	92,0	92,1	91,8	91,4	90,9	89,6	87,9	86,2	84,9	84,3
8	60	102,3	103,0	104,2	104,8	104,5	103,9	101,4	97,8	94,4	91,8	90,9
7	50	111,8	112,8	115,1	117,1	117,2	116,5	112,3	106,5	101,3	98,0	96,9
6	40	120,4	121,6	124,9	128,6	129,3	128,5	122,1	113,7	107,3	103,5	102,3
5	30	128,2	129,6	133,7	139,1	140,6	139,6	130,3	119,9	112,6	108,4	107,1
4	20	135,0	136,5	141,3	148,3	150,8	149,4	136,9	125,0	117,1	112,6	111,1
3	10	140,0	141,7	146,8	154,9	158,1	156,3	141,5	128,7	120,3	115,6	114,1
2	5	140,9	142,6	147,9	156,0	159,2	157,3	142,4	129,6	121,1	116,4	114,9
1	0	141,3	143,0	148,3	156,5	159,6	157,6	142,7	129,9	121,5	116,8	115,3

HIGH RESOLUTION CRTs FOR DATA DISPLAY

- 110° deflection angle
- 38 cm (15 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- white or green screen phosphor
- integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	38 cm (15 in)
Overall length	max. 279 mm*
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

These high resolution CRTs are intended for alpha-numeric and graphic display applications, such as computer terminals, word processors, etc.

The CRTs can be supplied with white (W) or green (GH and GR) phosphors and with or without anti-reflective bonded face-plate.

AVAILABLE VERSIONS

CRTs without anti-reflective face-plate with lugs	M38-328W M38-328GH M38-328GR	M38-330W M38-330GH M38-330GR	M38-334GR
CRTs with anti-reflective face-plate with lugs	M38-327W M38-327GH M38-327GR	M38-331GH M38-329GH	

See also Dimensional Data for the differences between the CRTs mentioned in the table above.

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* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 110°
horizontal	approx. 98°
vertical	approx. 81°
Direct interelectrode capacitances	
cathode to all other electrodes	approx. 3 pF
grid 1 to all other electrodes	approx. 7 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 600 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	W, GH and GR (P4, P31 and P39 respectively, according to EIA)
Light transmission at centre	
of screen	approx. 46%
of screen with anti-reflective face-plate	approx. 28%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

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* Implosion protection hardware is connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 279 mm*
Greatest dimensions of tube	
diagonal	383 mm
width	324 mm
height	262 mm
Minimum useful screen dimensions (projected)	
diagonal	352 mm
horizontal axis	292 mm
vertical axis	227 mm
area	665 cm^2
Implosion protection	rimband and/or anti-reflective face-plate
Bulb	EIA J–J380A1
Bulb contact designation	IEC 67-III-2; EIA J1-21
Base designation	IEC 67-1-31a; EIA B7-208
Basing	8 HR
Mass, without anti-reflective face-plate	approx. 4 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 19 kV min. 13 kV
Grid 4 (focusing electrode) voltage	–500 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%
Cathode-to-heater voltage	max. 100 V

---

* If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-reflective face-plate, raster dimensions 259 mm x 194 mm.

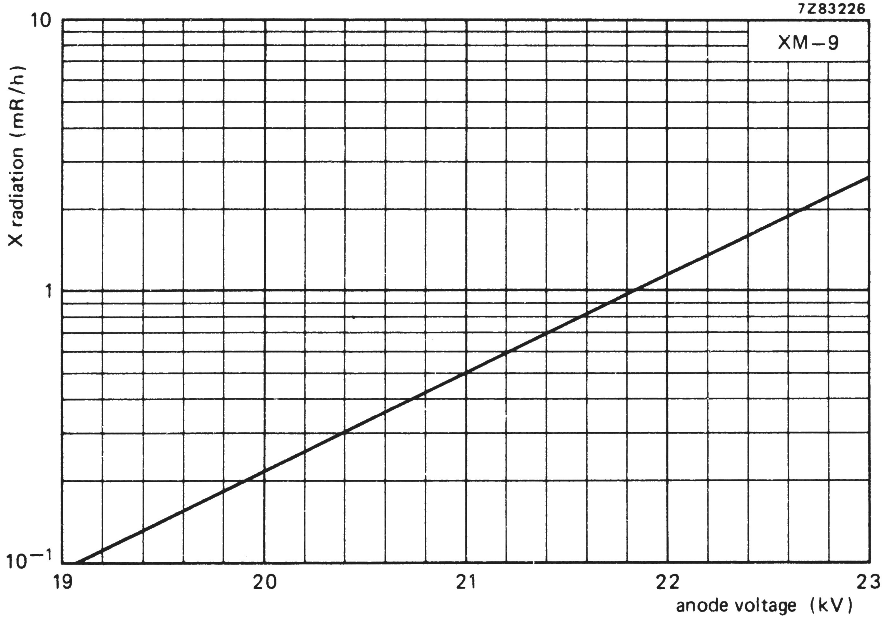
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

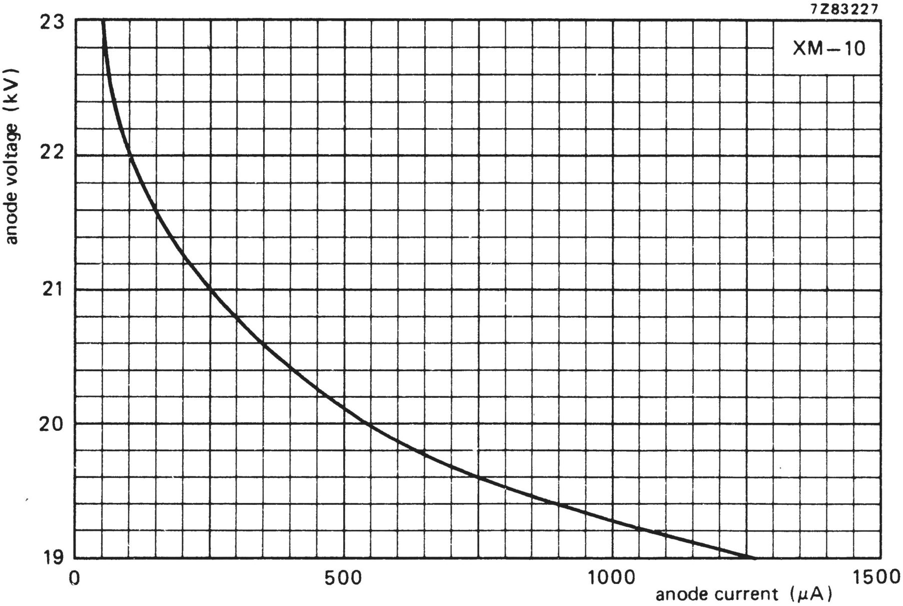
---

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V. For optimum overall sharpness dynamic focusing is recommended (typ. 250 V).

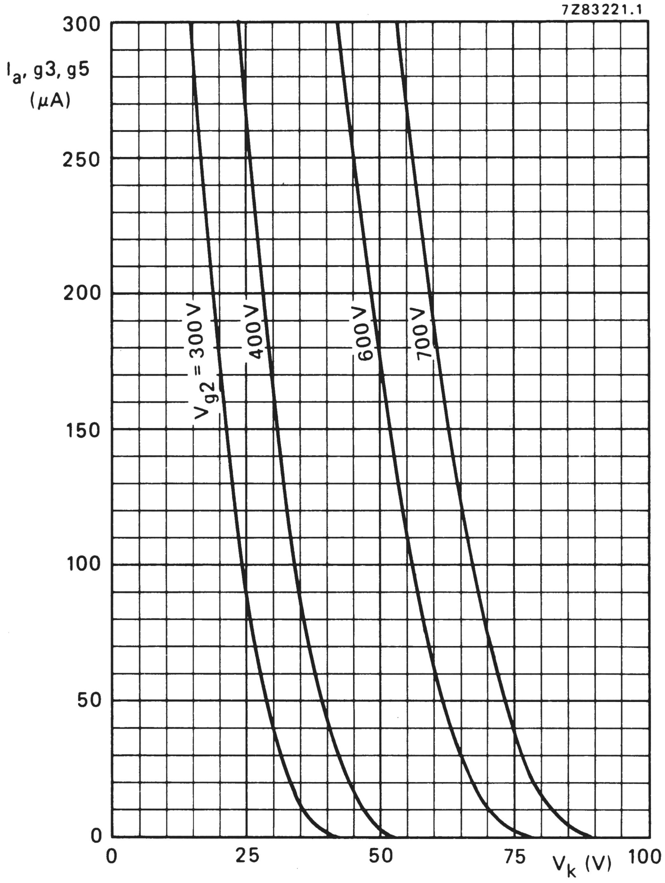
** Visual extinction of focused raster.



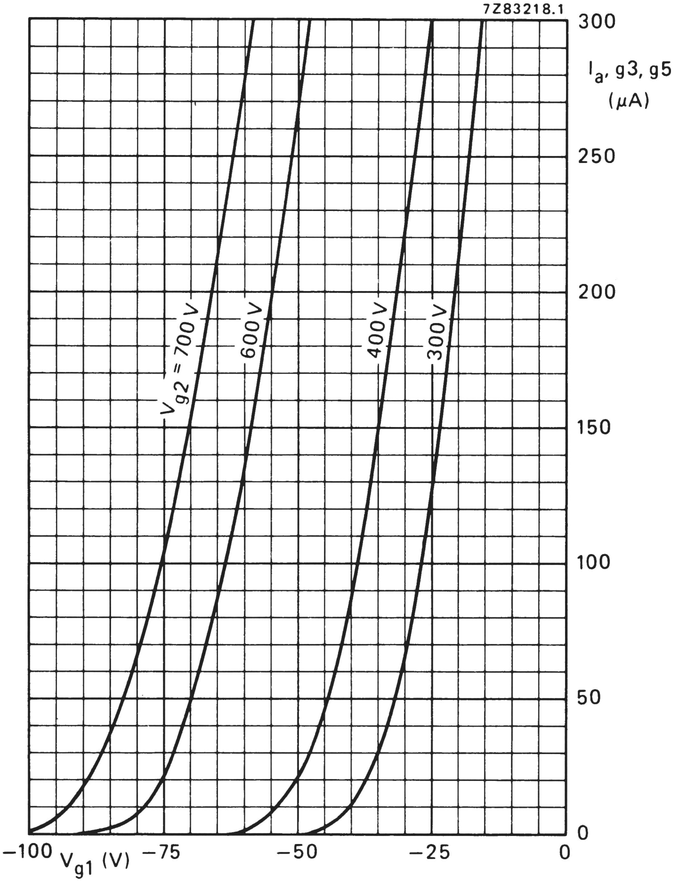
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to JEDEC64D.



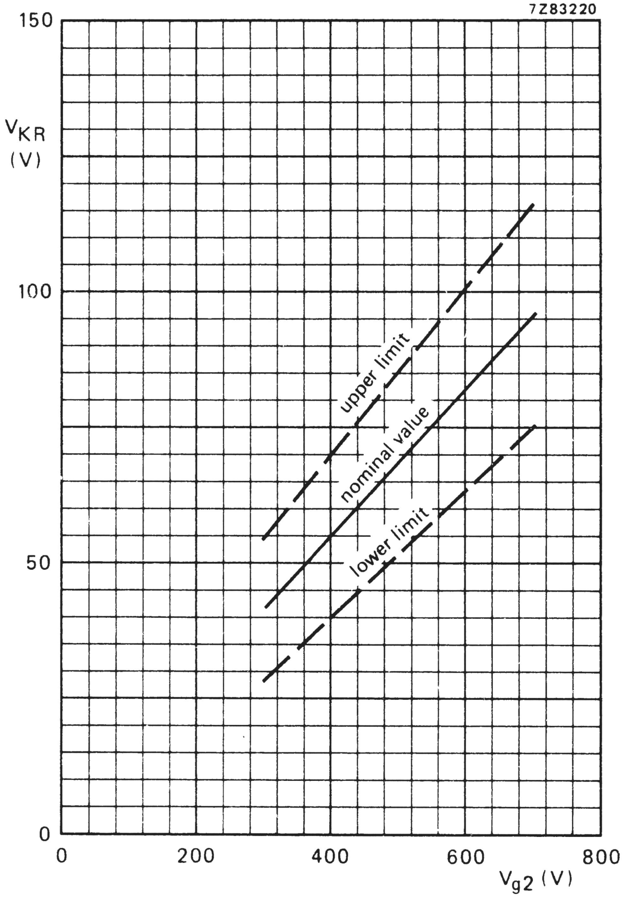
0,5 mR/h isoexposure rate limit curve, according to JEDEC94, measured according to JEDEC64D.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

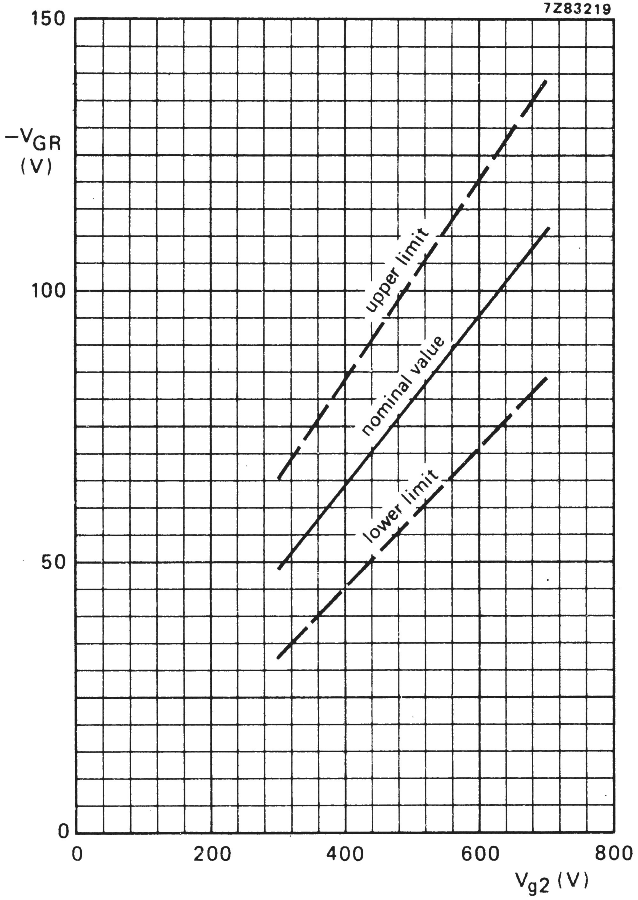


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}$$

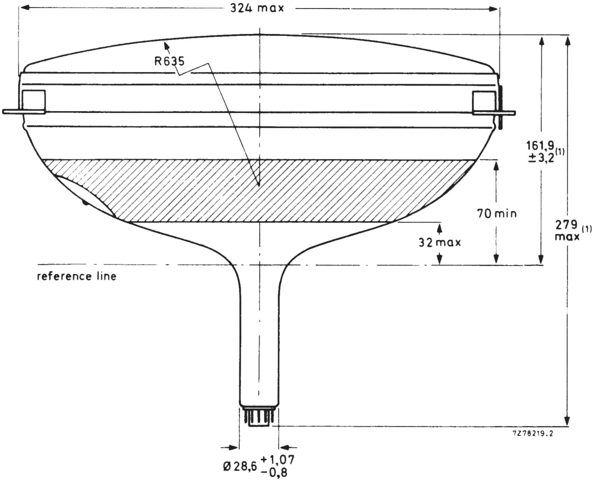


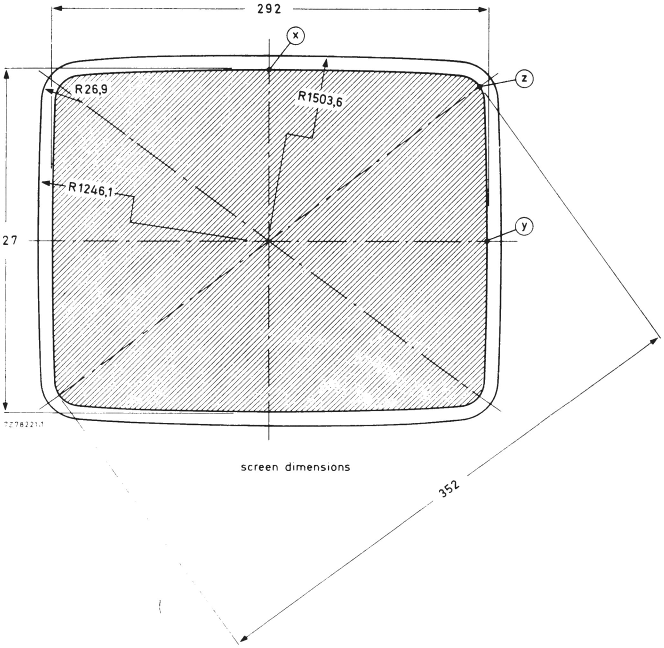
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

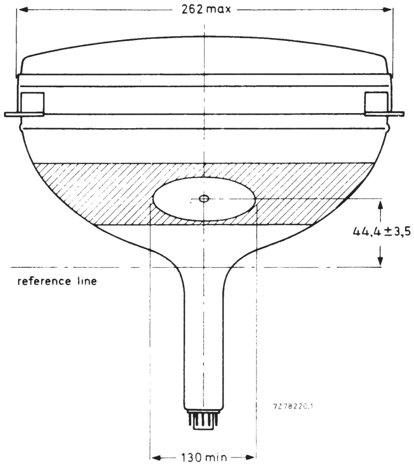
DIMENSIONAL DATA

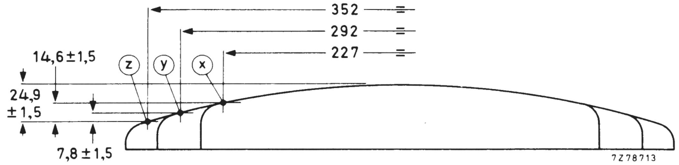
Dimensions in mm

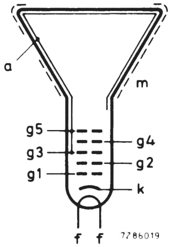

324 max
R635
161,9 ±3,2 (1)
70 min
279 max (1)
32 max
reference line
Ø 28,6 +1,07 −0,8
7Z78219.2

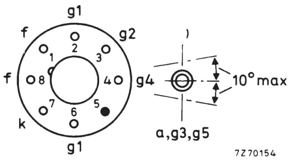

292
x
z
y
R26,9
R1503,6
R1246,1
227
7Z78221.1
screen dimensions
352

(1) If an anti-reflective face-plate is present, this dimension has to be increased by approx. 5,5 mm.

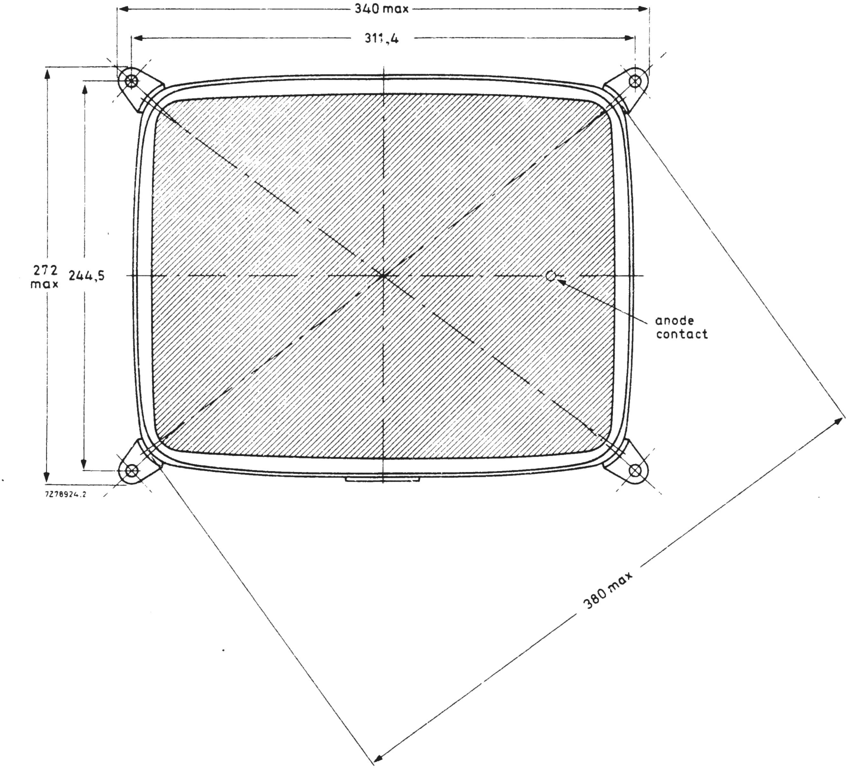

262 max
44,4 ± 3,5
reference line
7Z78220.1
130 min

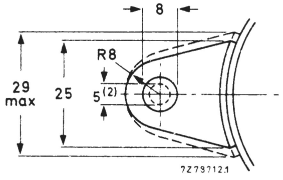

352
292
227
14,6 ± 1,5
24,9
± 1,5
7,8 ± 1,5
z
y
x
7Z78713

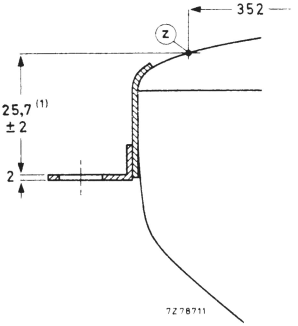

a
m
g5
g4
g3
g2
g1
k
f
f
7Z86019


g1
f
g2
1
2
3
f
8
4
g4
7
6
5
k
g1
10° max
a,g3,g5
7Z70154

Front view and lug dimensions of tubes M38-327 and M38-328


340 max
311,4
272 max
244,5
anode contact
380 max
7Z78924.2

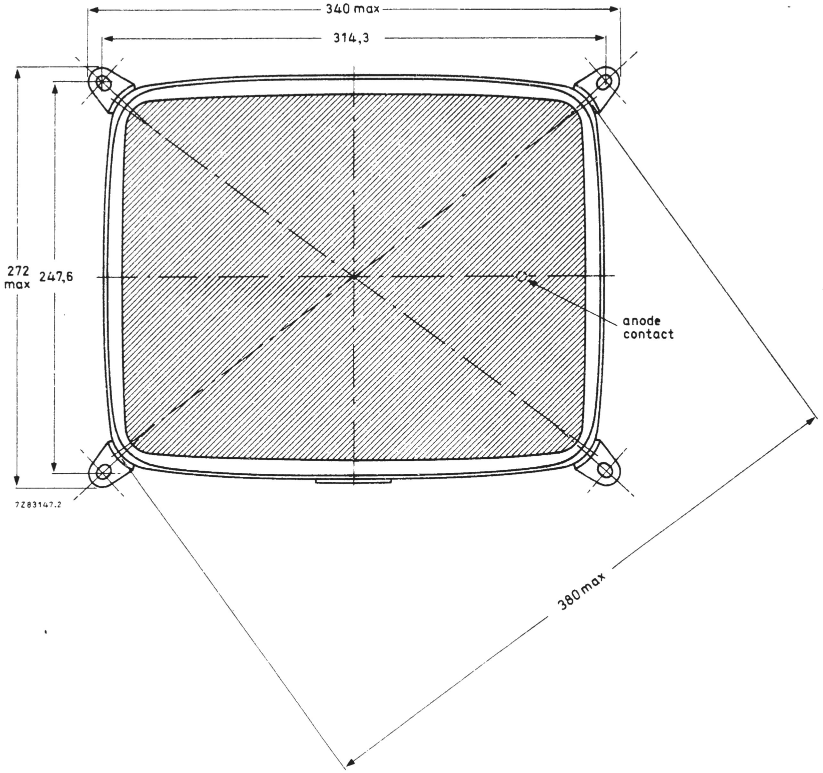

8
R8
29 max
25
5 (2)
7Z79712.1

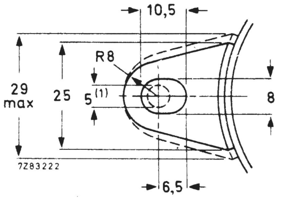

352
z
25,7 (1)
± 2
2
7Z78711

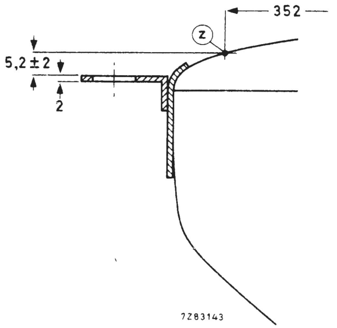
(1) For M38-327 (with anti-reflective face plate), this dimension has to be increased by approx. 5,5 mm.

(2) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 311,4 mm x 244,5 mm.

Front view and lug dimensions of tube M38-330

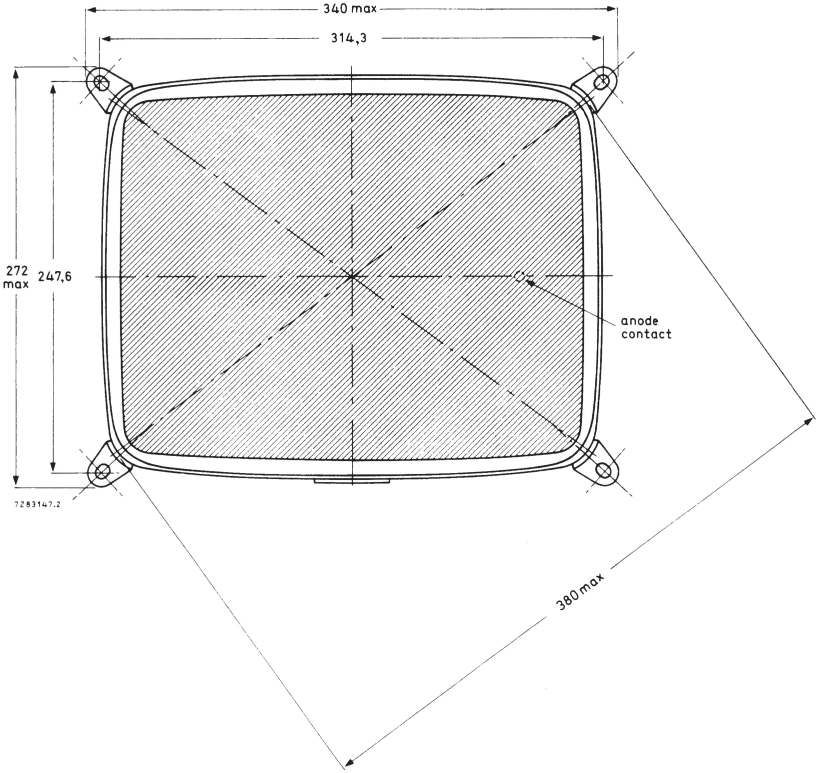

340 max
314,3
272 max
247,6
anode contact
380 max
7Z83147.2

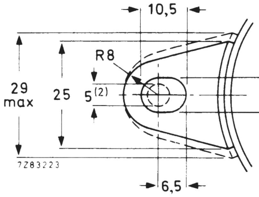

10,5
R8
29 max
25
5 (1)
8
6,5
7Z83222

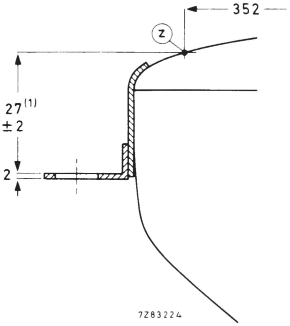

352
z
5,2 ± 2
2
7Z83143

(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tubes M38-331GH and M38-334GR

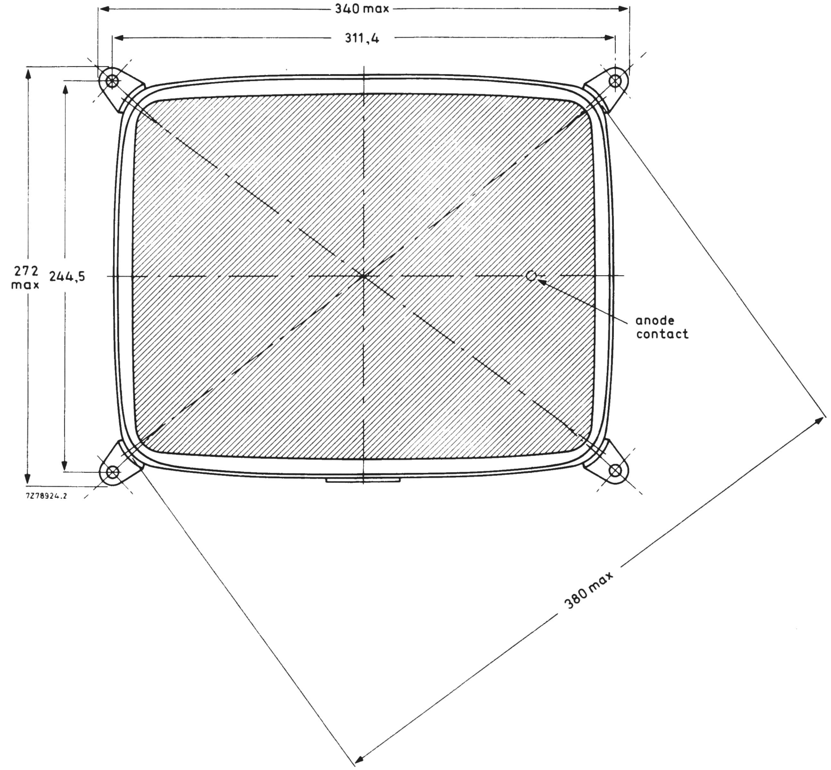

340 max
314,3
272
max
247,6
anode
contact
380 max
7Z83147.2

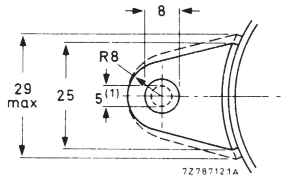

10,5
R8
29
max
25
5(2)
8
6,5
7Z83223

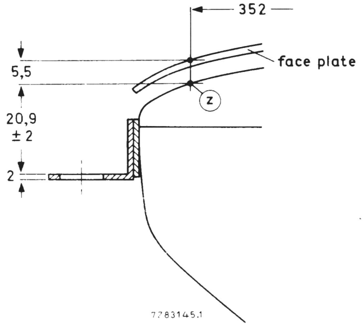

352
z
27(1)
±2
2
7Z83224

(1) For M38-331GH (with anti-reflective face-plate), this dimension has to be increased by approx. 5,5 mm.
(2) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-329GH

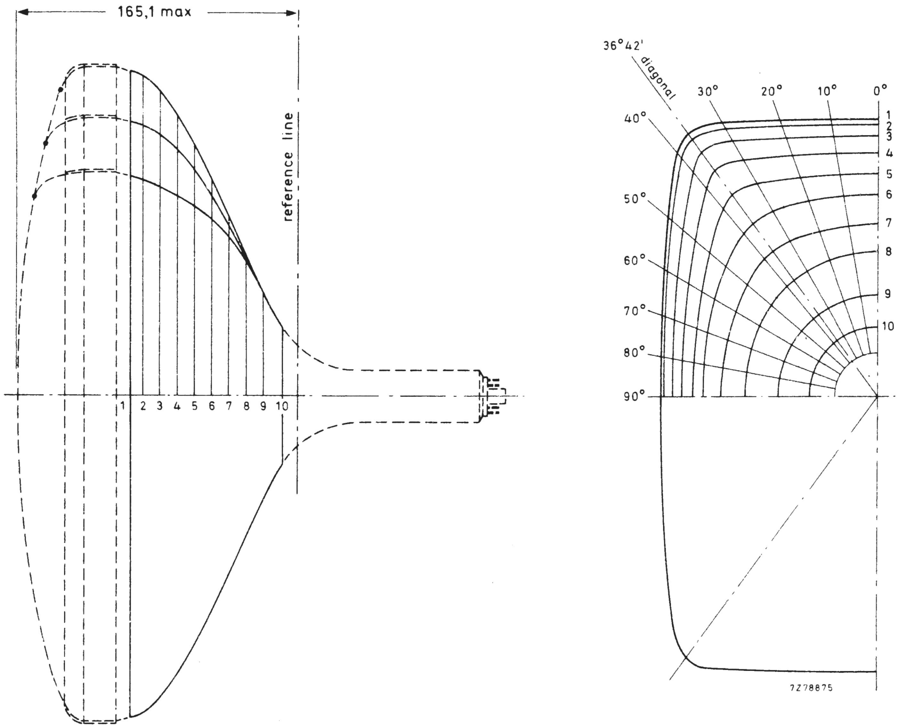

340 max
311,4
272 max
244,5
anode contact
380 max
7Z78924.2


8
R8
29 max
25
5(1)
7Z78712.1A


352
5,5
face plate
z
20,9 ± 2
2
7Z83145.1

(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 311,4 mm x 244,5 mm.

Maximum cone contour


165,1 max
reference line
1
2
3
4
5
6
7
8
9
10
36°42'
diagonal
30°
20°
10°
0°
40°
50°
60°
70°
80°
90°
1
2
3
4
5
6
7
8
9
10
7Z78875

section	nominal distance from ref. line	distance from centre (nom. values.)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	98,4	157,9	160,1	167,1	179,4	186,0	179,2	161,9	144,8	134,1	128,6	126,7
2	90,0	155,6	157,6	164,5	176,6	183,1	175,5	159,0	142,4	131,7	126,3	124,4
3	80,0	148,8	150,4	156,8	168,2	174,3	166,7	151,0	135,9	126,3	121,4	119,8
4	70,0	139,5	140,9	146,3	155,9	160,4	154,4	141,3	128,6	120,4	116,4	114,6
5	60,0	127,3	129,3	133,4	140,8	143,3	138,8	128,1	118,7	112,8	109,6	108,9
6	50,0	114,4	115,1	117,7	122,4	124,5	121,7	114,3	111,3	104,1	102,2	101,7
7	40,0	98,9	98,0	99,7	102,3	104,1	102,6	98,6	95,3	93,3	92,3	92,1
8	30,0	82,6	81,7	82,0	82,4	82,6	81,5	80,8	79,7	79,1	78,7	78,4
9	20,0	59,7	59,7	59,7	59,7	59,7	59,7	59,7	59,7	59,7	59,7	59,7
10	10,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0

COMPONENTS FOR COLOUR TELEVISION F

RECOMMENDED COMBINATIONS

90°

Picture tube	A37-570X	A37-590X	A42-570X	A42-590X	A51-570X A51-580X	A51-590X
Deflection unit	AT1205	AT1206	AT1215	AT1216	AT1237	AT1236 or AT1480
Screen diagonal	37 cm	37 cm	42 cm	42 cm	51 cm	51 cm
Multipole	AT1052	AT1052	AT1052	AT1052	AT1052	AT1052
Degaussing coil single insulation	3122 138 99840	3122 138 99840	3122 138 99850	3122 138 99850	3122 138 94440	3122 138 94440
Mains filter choke	AT4043/55	AT4043/55	AT4043/55	AT4043/55	AT4043/55	AT4043/55
Switched mode driver transformer	AT4043/58	AT4043/82	AT4043/58	AT4043/82	AT4043/58	AT4043/82
Switched mode transformer	AT2097/02		AT2097/02		AT2097/02	
Mains transformer		TS561/2 or TS521B		TS561/2 or TS521B		TS561/2 or TS521B
Current sensing transformer		AT4043/46		AT4043/46		AT4043/46
Input choke		AT4043/81		AT4043/81		AT4043/81
Sync. power-pack transformer		AT2076/80		AT2076/80		AT2076/80
Line output transformer	AT2076/51 or AT2076/81		AT2076/51 or AT2076/81		AT2076/51 or AT2076/81	
Linearity control unit	AT4042/02 or AT4042/04P		AT4042/02 or AT4042/04P		AT4042/02 or AT4042/04P	
East-West correction						

110°

Picture tube	A51-540X	A56-540X	A66-540X
Deflection unit	AT1250	AT1260	AT1270/00 or AT1271
Screen diagonal	51 cm	56 cm	66 cm
Degaussing coil			
single insulation	3122 138 75940 or	3122 138 75940 or	3122 138 75580 or
double insulation	3122 138 94380	3122 138 94380	3122 138 94350
Mains filter choke	AT4043/55	AT4043/55	AT4043/55
Switched mode driver transformer	AT4043/45	AT4043/45	AT4043/45
Mains transformer	TS561/2	TS561/2	TS561/2
Current sensing transformer	AT4043/46	AT4043/46	AT4043/46
Power-pack system supply choke	AT4043/52	AT4043/52	AT4043/52
Sync. power-pack transformer	AT2076/70	AT2076/70	AT2076/70
Power-pack system line choke	AT4043/53	AT4043/53	AT4043/53
Linearity control unit	AT4042/42 or AT4042/30	AT4042/42 or AT4042/30	AT4042/42 or AT4042/30

MULTI-POLE UNIT

QUICK REFERENCE DATA

Horizontal/vertical beam displacement (2-pole)	min.	13 mm
Static convergence		
red opposite to blue in any direction (4-pole)	min.	5 mm
red-blue with respect to green in any direction (6-pole)	min.	2,5 mm

APPLICATION

The unit has been designed for 37 cm (14 in), 42 cm (16 in) and 51 cm (20 in) 90° colour picture tubes with a neck diameter of 29,1 mm.

The purpose of the unit is:
- static convergence adjustment by means of the 4 and 6-pole rings;
- colour purity adjustment and adjustment of raster symmetry in N and S by means of the 2-pole rings.

DESCRIPTION

The unit incorporates six ring-shaped permanent magnets, supported by a non-magnetic plastic housing and a collet, which enables the unit to be clamped to the neck of the picture tube.

The magnetic rings comprise:
- one pair of 2-pole magnets
- one pair of 4-pole magnets
- one pair of 6-pole magnets

Rotating the 2 rings of a pair in opposite directions varies the *resultant field strength.* Rotating a pair of rings in the same direction varies the *direction of the resultant field.*

When the adjustment is finished, the rings are fixed in their position by a clamping ring.

MECHANICAL DATA

Outlines

See Fig. 1 on next page.

Dimensions in mm, and in inches between brackets

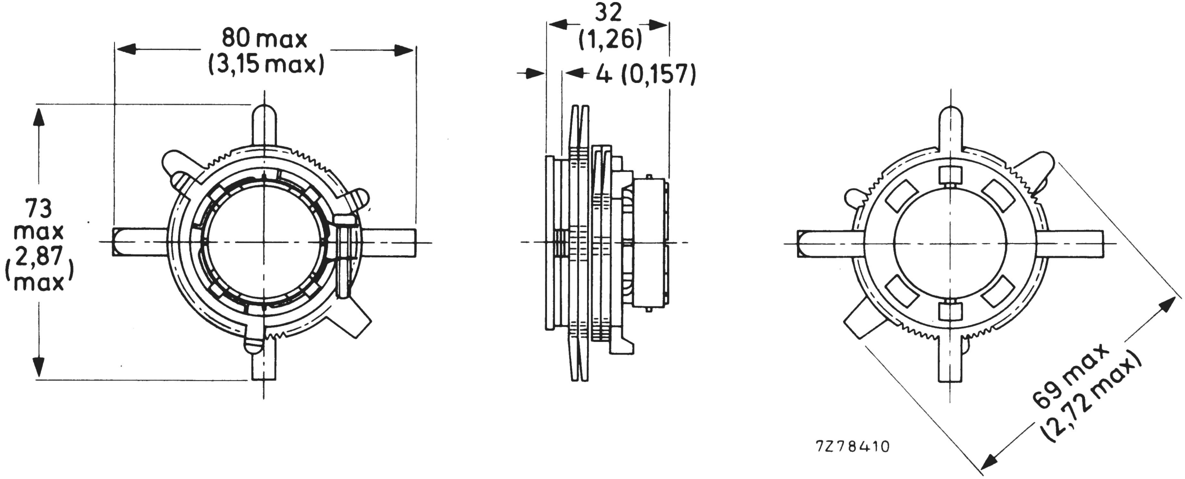

80 max
(3,15 max)
73
max
(2,87
max)
32
(1,26)
4 (0,157)
69 max
(2,72 max)
7Z78410

Fig. 1.

→ The multi-pole unit fits a tube with a neck diameter of 29,1 $^{+0,9}_{-0,7}$ mm (1,146 $^{+0,035}_{-0,028}$ inch).

Mounting

The unit should be mounted according to Fig. 2. For correct fitting of the unit the tube neck should be provided with adhesive tape. The unit will be clamped by turning the screw in the metal clamping ring with a torque of 1 Nm.

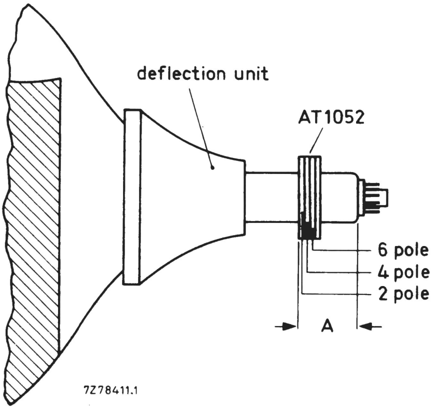
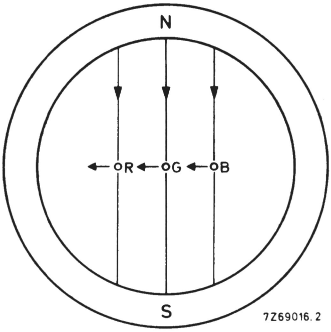

deflection unit
AT1052
6 pole
4 pole
2 pole
A
7Z78411.1

Fig. 2 Relative placement of deflection components on the colour picture tube; see Table 1 for dimension A.

Table 1

A_{min}	when used with picture tube
47 mm (1,85 in)	A37-570X 13VATP22
42,5 mm (1,67 in)	A51-570X A51-572X A51-575X 19VHWP22 19VLBP22
55 mm (2,17 in)	A51-580X A51-581X A51-582X 19VKUP22

ADJUSTMENTS


N
R
G
B
S
7Z69016.2

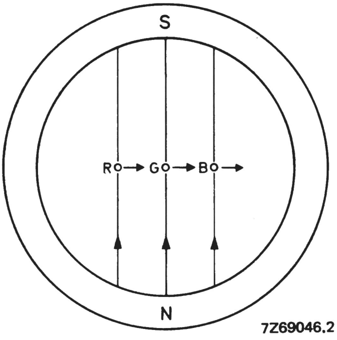
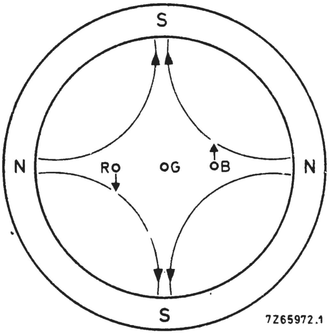

S
R
G
B
N
7Z69046.2

Fig. 3.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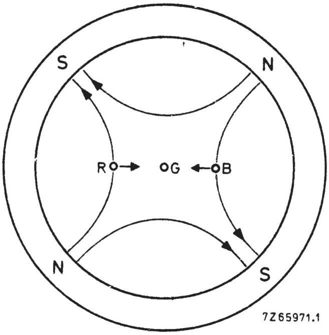
R
G
B
N
S
7Z65972.1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G
B
N
S
7Z65971.1

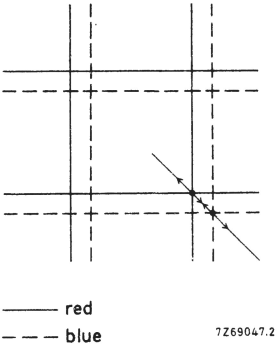
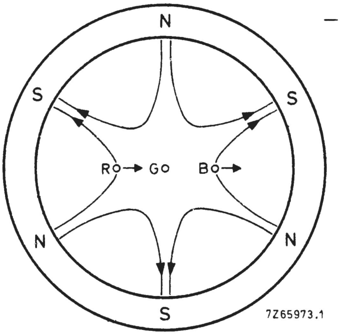

red
blue
7Z69047.2

Fig. 4.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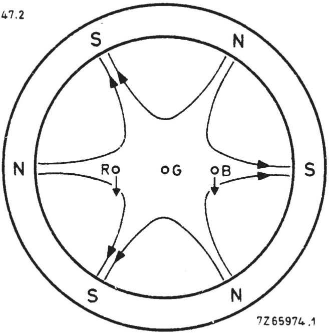
S
S
R
G
B
N
N
S
7Z65973.1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N
N
R
G
B
S
S
N
7Z65974.1

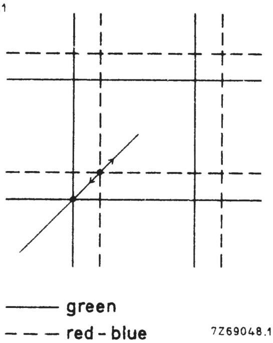

green
red - blue
7Z69048.1

Fig. 5.

DEFLECTON UNIT

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	37 cm (14 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	2,75 A (p-p)
Inductance of line coils, parallel connected	2,3 mH
Field deflection current, edge to edge at 25 kV	0,87 A (p-p)
Resistance of field coils, parallel connected	12,2 Ω

APPLICATION

This deflection unit, in conjunction with devices for colour purity and static convergence, is for 90° in-line colour picture tube A37-570X, with a neck diameter of 29,1 mm.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils and toroidal wound field deflection coils, thus forming a hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube. With the deflection unit positioned axially for optimum purity, a clearance is available at the front which permits adjustment of convergence by tilting the unit in the vertical and/or horizontal plane. Wedges are recommended to secure the deflection unit in the chosen position.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of $29{,}1^{+0{,}9}_{-0{,}7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

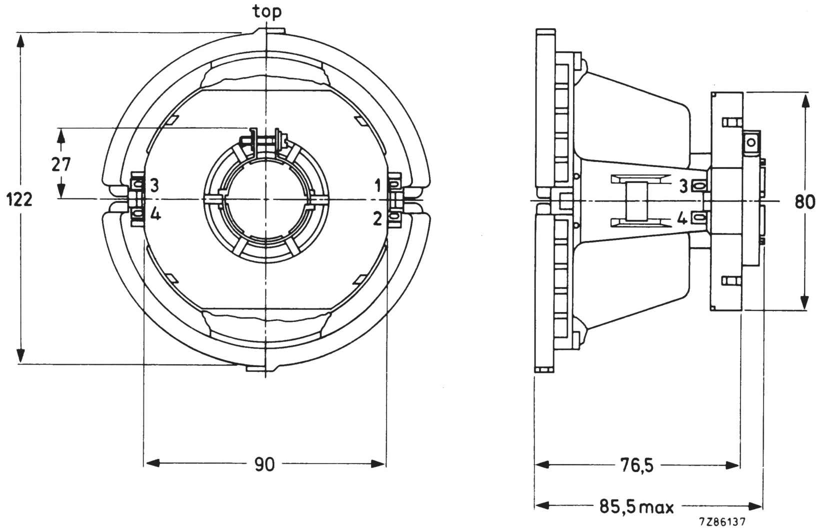


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+ 90 °C
Storage temperature range	−20 to + 90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 68-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	2,3 mH ± 5%
Resistance at 25 °C	2,25 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	2,75 A(p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	23 mH ± 10%
Resistance at 25 °C	12,2 Ω ± 7%
Field deflection current, edge to edge, at 25 kV	0,87 A(p-p)
Cross-talk	a voltage of 10 V, 15750 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

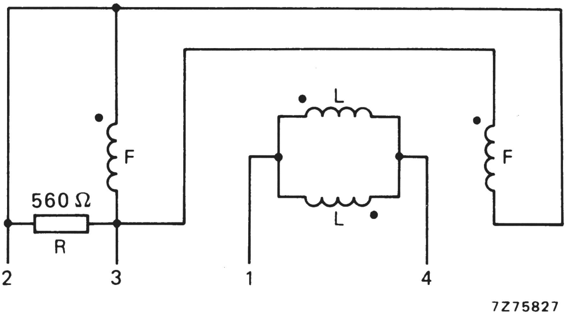


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

- **Raster Correction Free**

QUICK REFERENCE DATA

Picture tube		
gun arrangement	in line	
diagonal	37	cm (14 in)
neck diameter	29,1	mm
Deflection angle	90°	
Line deflection current, edge to edge at 25 kV	3,21	A(p-p)
Inductance of line coils, parallel connected	1,78	mH
Field deflection current, edge to edge at 25 kV	0,97	A(p-p)
Resistance of field coils, parallel connected	13,8	Ω

APPLICATION

This deflection unit, in conjunction which devices for colour purity and static convergence is for 90° in-line colour picture tube A37-590X, with a neck diameter of 29,1 mm.
The unit requires no raster correction circuitry.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils, toroidal wound field deflection coils, and metal fins, thus forming a raster correction free hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of $29,1^{+0,9}_{-0,7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

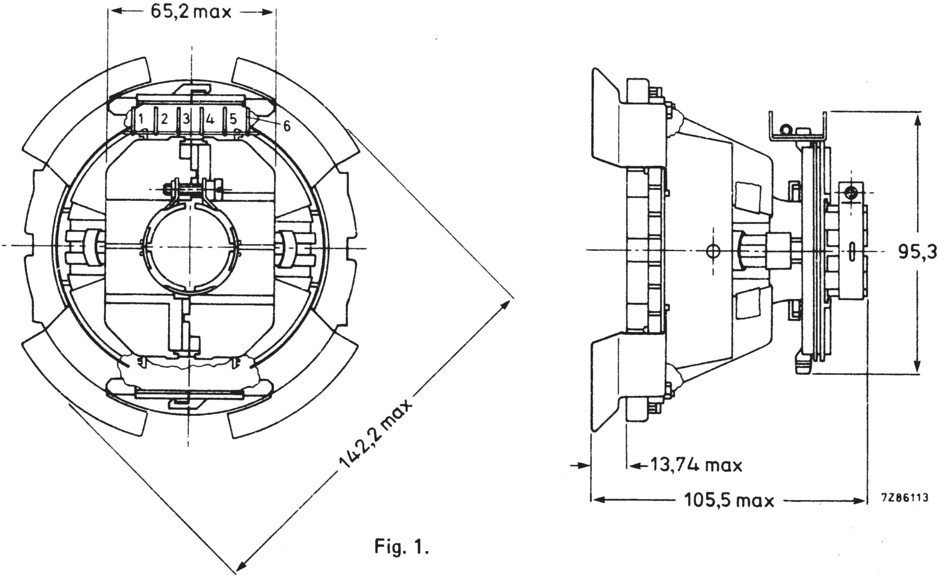


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+90 °C
Storage temperature range	–20 to +90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 68-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	1,78 mH ± 5%
Resistance at 25 °C	1,80 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	3,21 A(p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	28,7 mH ± 10%
Resistance at 25 °C	13,8 Ω ± 7%
Field deflection current, edge to edge, at 25 kV	0,97 A(p-p)
Cross-talk	a voltage of 10 V, 15625 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

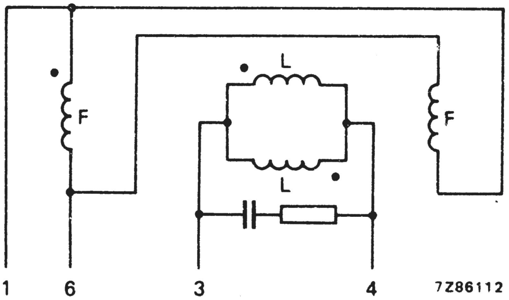


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	42 cm (16 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	2,75 A (p-p)
Inductance of line coils, parallel connected	2,3 mH
Field deflection current, edge to edge at 25 kV	0,87 A (p-p)
Resistance of field coils, parallel connected	12,2 Ω

APPLICATION

This deflection unit, in conjunction with devices for colour purity and static convergence, is for 90° in-line colour picture tube A42-570X, with a neck diameter of 29,1 mm.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils and toroidal wound field deflection coils, thus forming a hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube. With the deflection unit positioned axially for optimum purity, a clearance is available at the front which permits adjustment of convergence by tilting the unit in the vertical and/or horizontal plane. Wedges are recommended to secure the deflection unit in the chosen position.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of $29{,}1\,^{+0{,}9}_{-0{,}7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

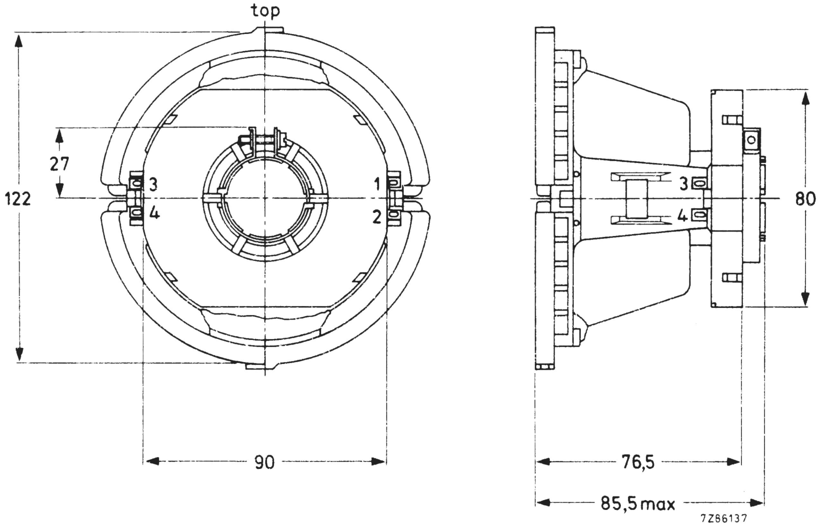


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+ 90 °C
Storage temperature range	−20 to + 90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 68-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	2,3 mH ± 5%
Resistance at 25 °C	2,25 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	2,75 A(p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	23 mH ± 10%
Resistance at 25 °C	12,2 Ω ± 7%
Field deflection current, edge to edge, at 25 kV	0,87 A(p-p)
Cross-talk	a voltage of 10 V, 15750 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

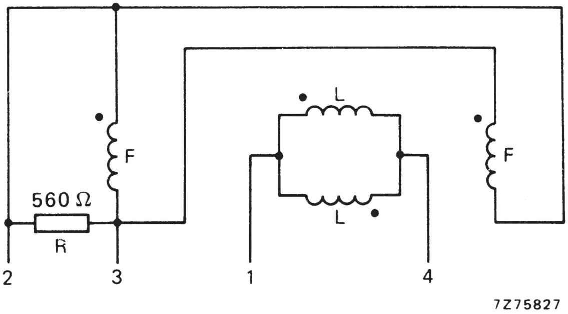


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

- **Raster Correction Free**

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	42 cm (16 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	3,28 A (p-p)
Inductance of line coils, parallel connected	1,73 mH
Field deflection current, edge to edge at 25 kV	0,97 A (p-p)
Resistance of field coils, parallel connected	13,8 Ω

APPLICATION

This deflection unit, in conjunction which devices for colour purity and static convergence is for 90° in-line colour picture tube A42-590X, with a neck diameter of 29,1 mm.
The unit requires no raster correction circuitry.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils, toroidal wound field deflection coils, and metal fins, thus forming a raster correction free hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of $29,1^{+0,9}_{-0,7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

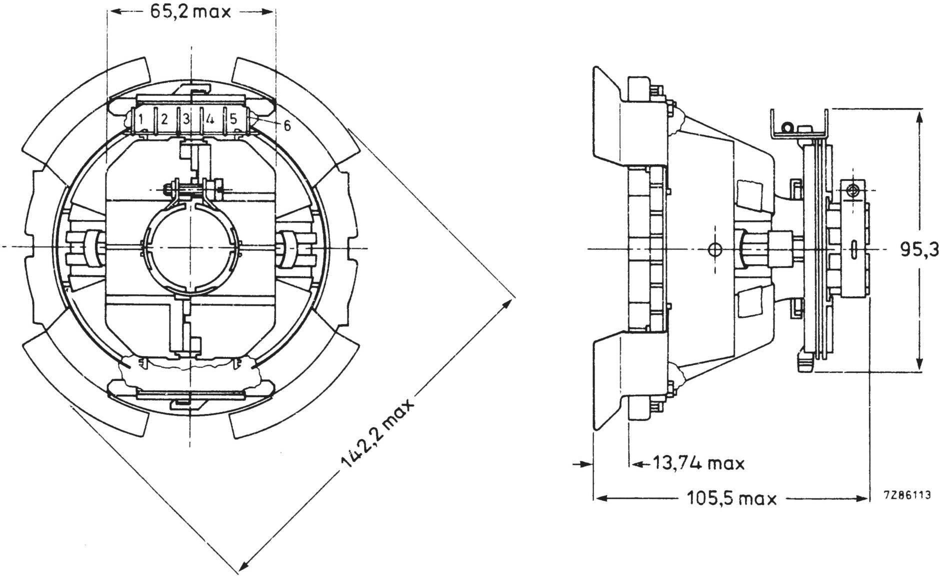


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+ 90 °C
Storage temperature range	−20 to + 90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 68-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	1,73 mH ± 5%
Resistance at 25 °C	1,79 Ω ± 10%
Line deflection current, edge to edge at 25 kV	3,28 A (p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	28,7 mH ± 10%
Resistance at 25 °C	13,8 Ω ± 7%
Field deflection current, edge to edge at 25 kV	0,97 A (p-p)
Cross-talk	a voltage of 10 V, 15 625 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

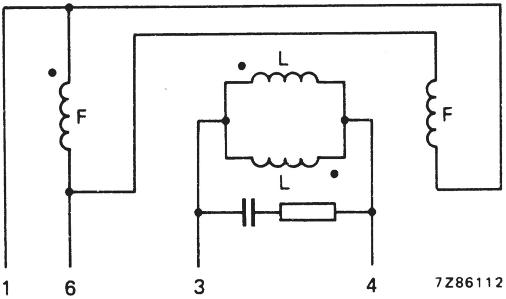


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

- **Raster Correction Free**

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	51 cm (20 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	3,0 A p-p
Inductance of line coils, parallel connected	1,91 mH
Field deflection current, edge to edge at 25 kV	0,82 A p-p
Resistance of field coils, parallel connected	13,6 Ω

APPLICATION

This deflection unit, in conjunction which devices for colour purity and static convergence is for 90° in-line colour picture tube A51-590X, with a neck diameter of 29,1 mm.
The unit requires no raster correction circuitry.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils, toroidal wound field deflection coils, and metal fins, thus forming a raster correction free hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of $29{,}1\,^{+0{,}9}_{-0{,}7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

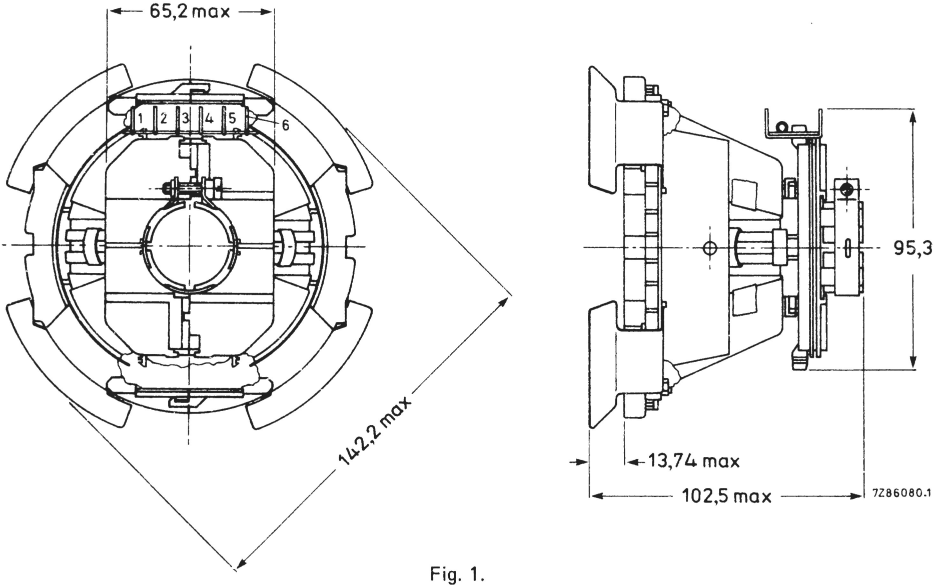


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+ 90 °C
Storage temperature range	−20 to + 90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 66-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	1,91 mH ± 5%
Resistance at 25 °C	1,75 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	3,0 A (p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	29 mH ± 10%
Resistance at 25 °C	13,6 Ω ± 7%
Field deflection current, edge to edge, at 25 kV	0,82 A (p-p)
Cross-talk	a voltage of 10 V, 15 625 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

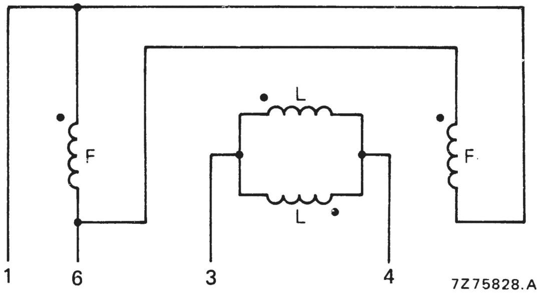


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges places between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube, gun arrangement	in line
diagonal	51 cm (20 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	2,75 A p-p
Inductance of line coils, parallel connected	2,3 mH
Field deflection current, edge to edge at 25 kV	0,86 A p-p
Resistance of field coils, parallel connected	12,4 Ω

APPLICATION

This deflection unit is designed for 90° in-line colour picture tube A51-580X, with a neck diameter of 29,1 mm, to operate in conjunction with devices for colour purity and static convergence.

DESCRIPTION

The deflection unit consists of saddle-shaped horizontal coils and toroidal wound vertical coils, thus forming a hybrid yoke. The unit is provided with a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube. With the deflection unit positioned axially for optimum purity, a clearance is available at the front which permits adjustment of convergence by tilting the unit in the vertical and/or horizontal plane. Wedges are recommended to secure the deflection unit in the chosen position.

MECHANICAL DATA

Outlines Dimensions in mm

The deflection unit fits a tube with a neck diameter of $29,1\,^{+0,9}_{-0,7}$ mm.

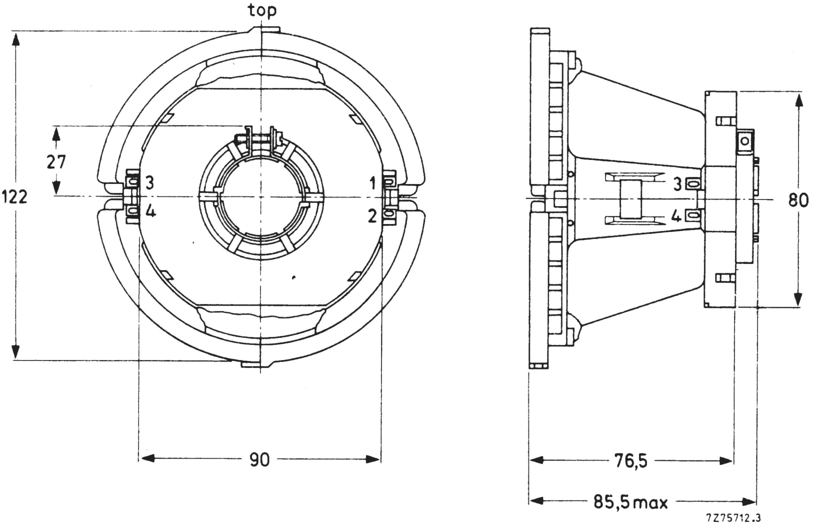


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+90 °C
Storage temperature range	−20 to +90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC68-2-6 (test Fc)
Bump	IEC68-2-29 (test Eb; 35g)
Cold	IEC68-2-1 (test Ab)
Dry heat	IEC68-2-2 (test Bb)
Damp heat, steady state	IEC68-2-3 (test Ca)
Cyclic damp heat	IEC68-2-30 (test Db)
Change of temperature	IEC68-2-14 (test Nb)

ELECTRICAL DATA

Horizontal coils	
Inductance at 1 V (r.m.s.), 1 kHz	2,3 mH ± 5%
Resistance at 25 °C	2,25 Ω ± 10%
Vertical coils	
Inductance at 1 V (r.m.s.), 1 kHz	23,0 mH ± 10%
Resistance at 25 °C	12,4 Ω ± 7%
Typical currents with Ea = 25 kV and full scan	
Horizontal I_H	2,75 A (p-p)
Vertical I_V	0,86 A (p-p)
Cross-talk	a voltage of 10 V, 15 625 Hz applied to horizontal coils causes no more than 0,2 V across the vertical coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between horizontal and vertical coils	> 500 MΩ
between horizontal coil and core clamp	> 500 MΩ
between vertical coil and core clamp	> 10 MΩ

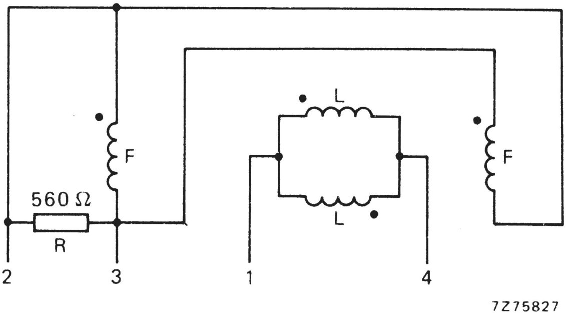


Fig. 2 Connection diagram. L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube, gun arrangement	in line
diagonal	51 cm (20 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	3,25 A p-p
Inductance of line coils, parallel connected	1,63 mH
Field deflection current, edge to edge at 25 kV	0,80 A p-p
Resistance of field coils, parallel connected	15 Ω

APPLICATION

This deflection unit is designed for 90° in-line colour picture tube A51-580X, with a neck diameter of 29,1 mm, to operate in conjunction with devices for colour purity and static convergence.

DESCRIPTION

The deflection unit consists of saddle-shaped horizontal coils and toroidal wound vertical coils, thus forming a hybrid yoke. The unit is provided with a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube. With the deflection unit positioned axially for optimum purity, a clearance is available at the front which permits adjustment of convergence by tilting the unit in the vertical and/or horizontal plane. Wedges are recommended to secure the deflection unit in the chosen position.

MECHANICAL DATA

Outlines Dimensions in mm

The deflection unit fits a tube with a neck diameter of $29,1 \begin{smallmatrix} +0,9 \\ -0,7 \end{smallmatrix}$ mm.

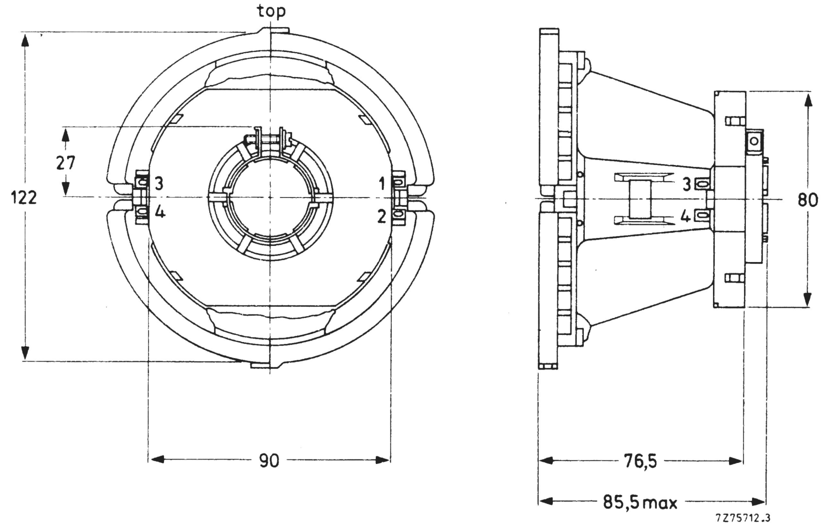


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+90 °C
Storage temperature range	−20 to +90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC68-2-6 (test Fc)
Bump	IEC68-2-29 (test Eb; 35g)
Cold	IEC68-2-1 (test Ab)
Dry heat	IEC68-2-2 (test Bb)
Damp heat, steady state	IEC68-2-3 (test Ca)
Cyclic damp heat	IEC68-2-30 (test Db)
Change of temperature	IEC68-2-14 (test Nb)

ELECTRICAL DATA

Horizontal coils	
Inductance at 1 V (r.m.s.), 1 kHz	1,63 mH ± 5%
Resistance at 25 °C	1,9 Ω ± 10%
Vertical coils	
Inductance at 1 V (r.m.s.), 1 kHz	28,5 mH ± 10%
Resistance at 25 °C	15 Ω ± 7%
Typical currents with Ea = 25 kV and full scan	
Horizontal I_H	3,25 A (p-p)
Vertical I_V	0,80 A (p-p)
Cross-talk	a voltage of 10 V, 15 625 Hz applied to horizontal coils causes no more than 0,2 V across the vertical coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between horizontal and vertical coils	> 500 MΩ
between horizontal coil and core clamp	> 500 MΩ
between vertical coil and core clamp	> 10 MΩ

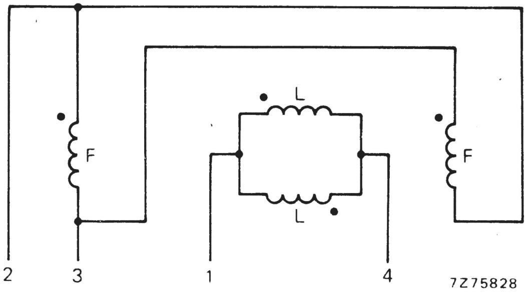


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges has to be cemented on to the picture tube.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube gun arrangement	in line
diagonal	51 cm (20 in)
neck diameter	36,5 mm
Deflection angle	110°
Line deflection current, edge to edge at 25 kV	4,8 A p-p
Inductance of line coils	1,53 mH
Resistance of field coils (damping resistor R1 included)	6,2 Ω

APPLICATION

This deflection unit has been designed for use with a 110° colour picture tube type A51-540X in CTV receivers in conjunction with e.g.:

diode-split line output transformer	AT2076/70
line output transistor	BU208A
linearity control unit	AT4042/42

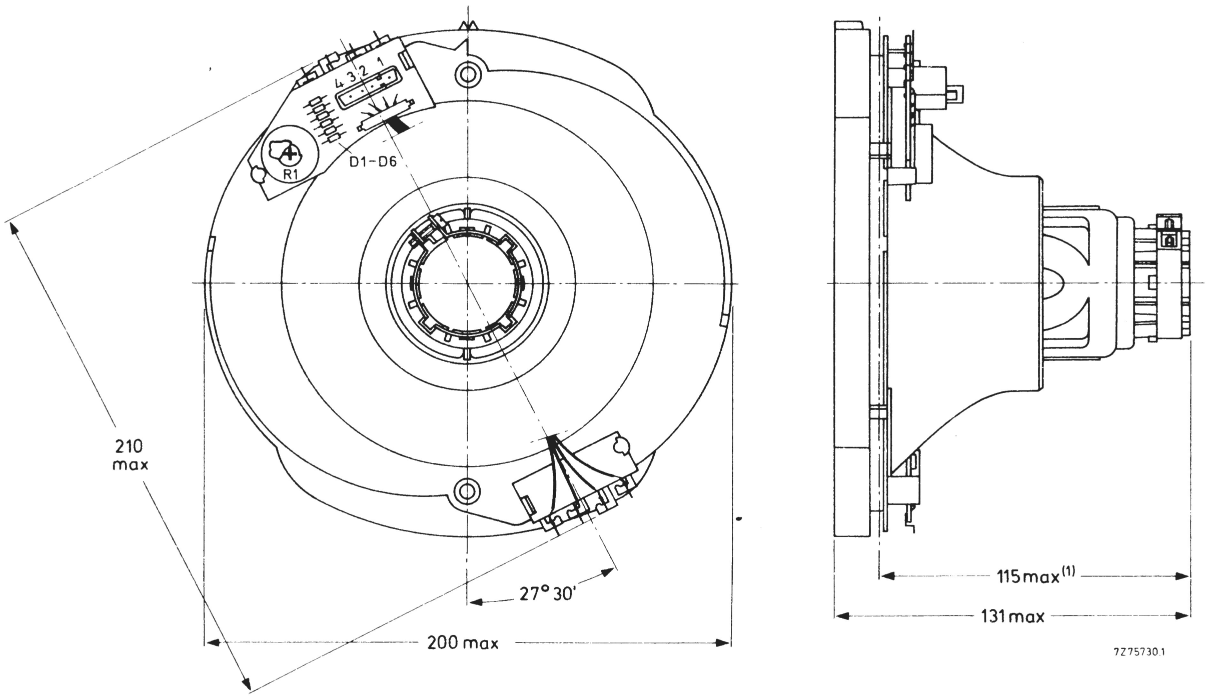
DESCRIPTION

The deflection unit consists of flangeless line and field coils, a one piece ferrite ring and a one piece coil carrier.

MECHANICAL DATA

Outlines

Dimensions in mm


4 3 2 1
R1
D1–D6
210
max
27° 30'
200 max
115 max (1)
131 max
7Z75730.1

(1) Reference plane of centring bosses.

Fig. 1.

Mounting

The deflection unit can simply be pushed on the neck of a picture tube.

Both on the neck of the tube and on the deflection unit, there are 3 reference surfaces to establish angular and axial positioning.

Once the unit is mounted the combination is perfectly aligned and requires no further adjustment for static convergence, colour purity and raster orientation.

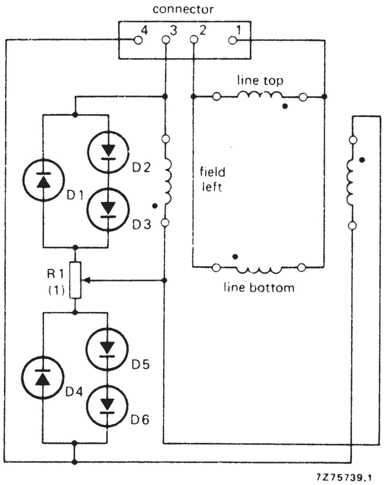
The unit must be pressed against the reference surfaces on the cone of the picture tube with a force of 20 ± 5 N and fixed by tightening the screw in the clamping ring at the rear with a torque of 1,4 Nm. Maximum axial force exerted on the screw is 20 N.

ELECTRICAL DATA

Line coils	
inductance	1,53 mH ± 4%
resistance at 25 °C	1,4 Ω ± 10%
Line deflection current edge to edge at 25 kV	4,8 A p-p
Field coils	
inductance	9,7 mH ± 10%
resistance at 25 °C (damping resistance R1 included)	6,2 Ω ± 7%
Field deflection current edge to edge at 25 kV	2,0 A p-p
Max. operating temperature	90 °C

Connections

(See also Fig. 1).



● Means winding direction.

Fig. 2.

Matching female Stocko connector MKF 804-1-0-404.
D1 to D6 = BAS11, BAX18 or BAX18A.

(1) R1 is factory adjusted and locked with adhesive.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube gun arrangement	in line
diagonal	56 cm (22 in)
neck diameter	36,5 mm
Deflection angle	110°
Line deflection current, edge to edge at 25 kV	5,0 A p-p
Inductance of line coils	1,5 mH
Resistance of field coils (damping resistor R1 included)	5,9 Ω

APPLICATION

This deflection unit has been designed for use with a 110° colour picture tube type A56-540X in CTV receivers in conjunction with e.g.:

diode-split line output transformer	AT2076/70
line output transistor	BU208A
linearity control unit	AT4042/42

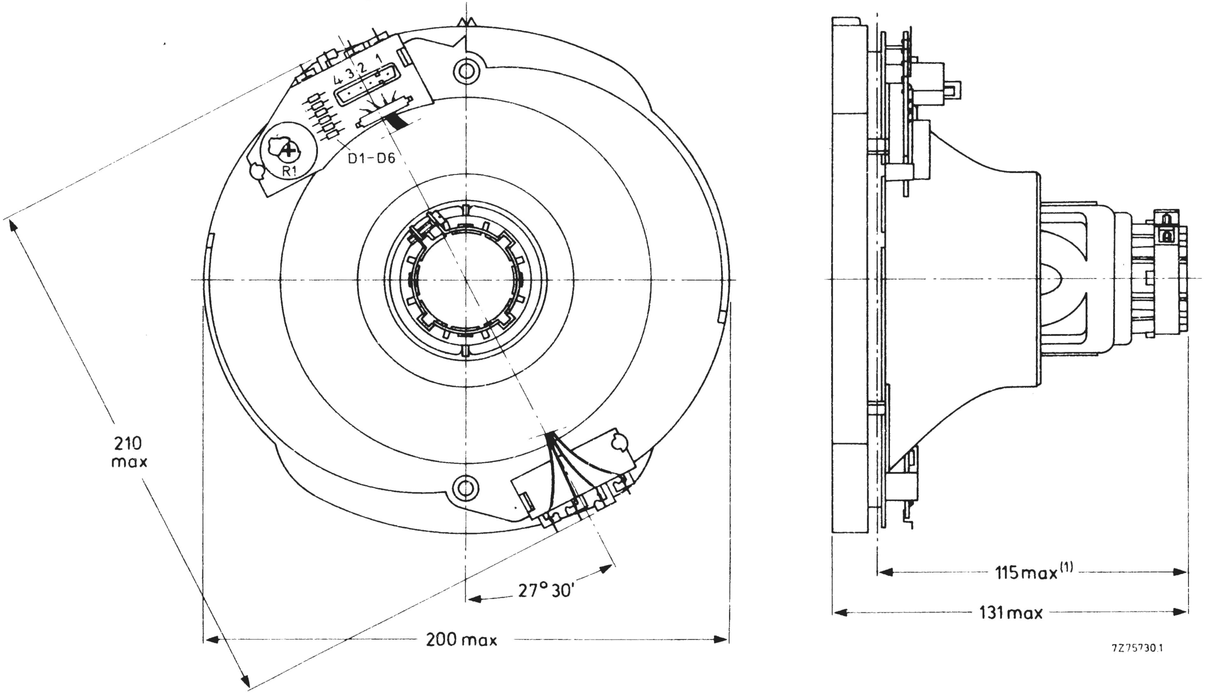
DESCRIPTION

The deflection unit consists of flangeless line and field coils, a one piece ferrite ring and a one piece coil carrier.

MECHANICAL DATA

Outlines

Dimensions in mm


4 3 2 1
D1-D6
R1
210
max
27° 30'
200 max
115 max (1)
131 max
7Z75730.1

(1) Reference plane of centring bosses.

Fig. 1.

Mounting

The deflection unit can simply be pushed on the neck of a picture tube.

Both on the neck of the tube and on the deflection unit, there are 3 reference surfaces to establish angular and axial positioning.

Once the unit is mounted the combination is perfectly aligned and requires no further adjustement for static convergence, colour purity and raster orientation.

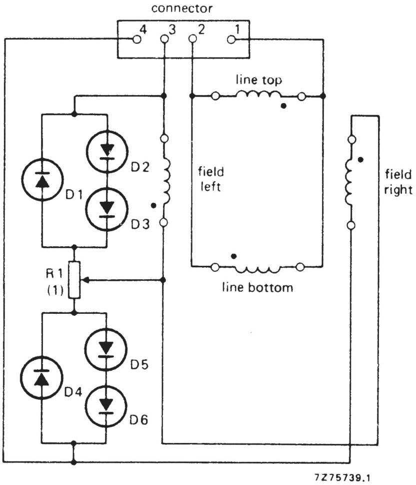
The unit must be pressed against the reference surfaces on the cone of the picture tube with a force of 20 ± 5 N and fixed by tightening the screw in the clamping ring at the rear with a torque of 1,4 Nm. Maximum axial force exerted on the screw is 20 N.

ELECTRICAL DATA

Line coils	
inductance	1,5 mH ± 4%
resistance at 25 °C	1,3 Ω ± 10%
Line deflection current edge to edge at 25 kV	5,0 A p-p
Field coils	
inductance	10,0 mH ± 10%
resistance at 25 °C (damping resistance R1 included)	5,9 Ω ± 7%
Field deflection current edge to edge at 25 kV	1,95 A p-p
Max. operating temperature	90 °C

Connections

(See also Fig. 1).



● Means winding direction.

Fig. 2.

Matching female Stocko connector MKF 804-1-0-404.
D1 to D6 = BAS11, BAX18 or BAX18A.

(1) R1 is factory adjusted and locked with adhesive.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube gun arrangement	in line
diagonal	66 cm (26 in)
neck diameter	36,5 mm
Deflection angle	110°
Line deflection current, edge to edge at 25 kV	5,1 A p-p
Inductance of line coils	1,5 mH
Resistance of field coils (damping resistor R1 included)	5,85 Ω

APPLICATION

This deflection unit has been designed for use with a 110° colour picture tube type A66-540X in CTV receivers in conjunction with e.g.:

diode-split line output transformer	AT2076/70
line output transistor	BU208A
linearity control unit	AT4042/42

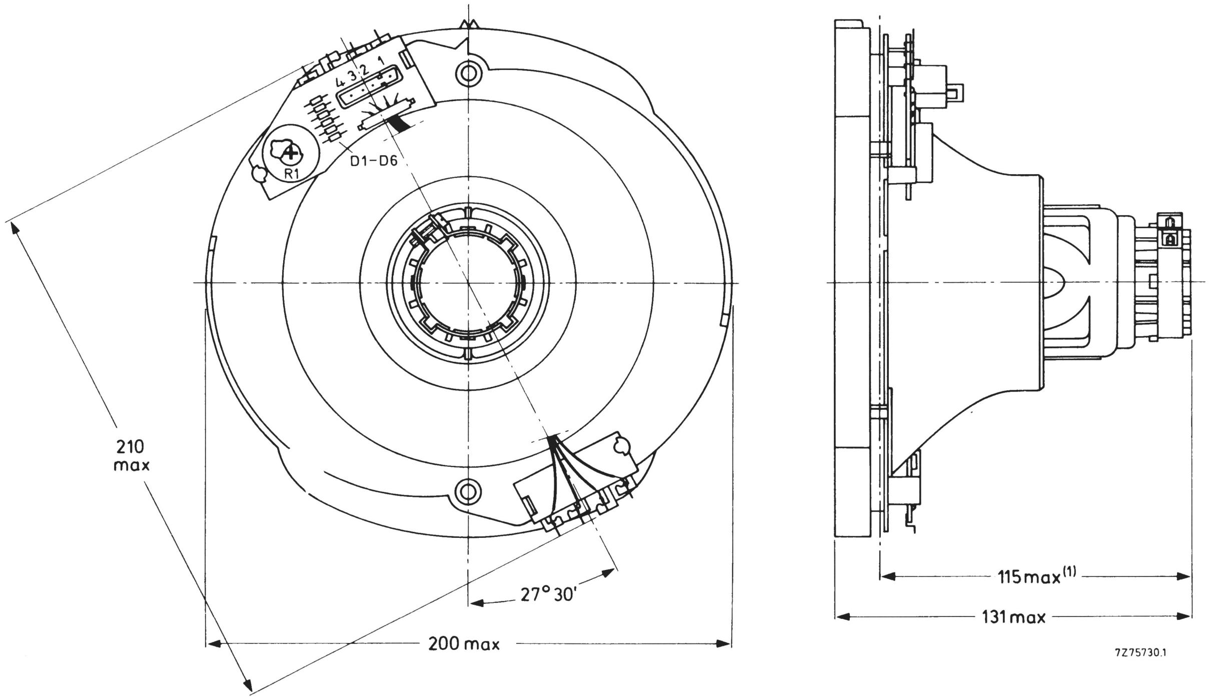
DESCRIPTION

The deflection unit consists of flangeless line and field coils, a one piece ferrite ring and a one piece coil carrier.

MECHANICAL DATA

Outlines

Dimensions in mm


4 3 2 1
D1–D6
R1
210 max
27° 30'
200 max
115 max (1)
131 max
7Z75730.1

(1) Reference plane of centring bosses.

Fig. 1.

Mounting

The deflection unit can simply be pushed on the neck of a picture tube.

Both on the neck of the tube and on the deflection unit, there are 3 reference surfaces to establish angular and axial positioning.

Once the unit is mounted the combination is perfectly aligned and requires no further adjustment for static convergence, colour purity and raster orientation.

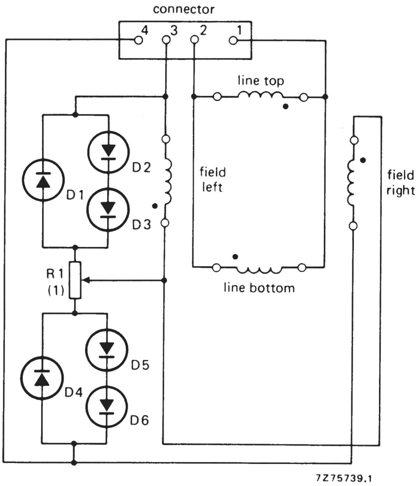
The unit must be pressed against the reference surfaces on the cone of the picture tube with a force of 20 ± 5 N and fixed by tightening the screw in the clamping ring at the rear with a torque of 1,4 Nm. Maximum axial force exerted on the screw is 20 N.

ELECTRICAL DATA

Line coils	
inductance	1,5 mH ± 4%
resistance at 25 °C	1,3 Ω ± 10%
Line deflection current edge to edge at 25 kV	5,1 A p-p
Field coils	
inductance	9,7 mH ± 10%
resistance at 25 °C (damping resistance R1 included)	5,85 Ω ± 7%
Field deflection current edge to edge at 25 kV	2,0 A p-p
Max. operating temperature	90 °C

Connections

(See also Fig. 1).



● Means winding direction

Fig. 2.

Matching female Stocko connector MKF 804-1-0-404.
D1 to D6 = BAS11, BAX18 or BAX18A.

(1) R1 is factory adjusted and locked with adhesive.

DEFLECTION UNIT

- With scan velocity modulation (s.v.m.) for improved picture sharpness

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	66 cm (26 in)
neck diameter	36,5 mm
Deflection angle	110°
Line deflection current, edge to edge at 25 kV	5,1 A p-p
Inductance of line coils	1,5 mH
Resistance of field coils (damping resistor R1 included)	5,85 Ω

APPLICATION

This deflection unit has been designed for use with a 110° colour picture tube type A66-540X in CTV receivers in conjunction with e.g.:

diode-split power pack transformer	AT2076/70
line output transistor	BU208A
linearity control unit	AT4042/42 or AT4042/30

For the scan velocity modulation* additional circuitry is required.

DESCRIPTION

The deflection unit consists of flangeless line and field coils, a one piece ferrite ring and a one piece coil carrier. The s.v.m. coils are incorporated in the unit.

Connection to the s.v.m. coils can be made via a connector. Connection to the deflection coils can be made via a connector or solder tags.

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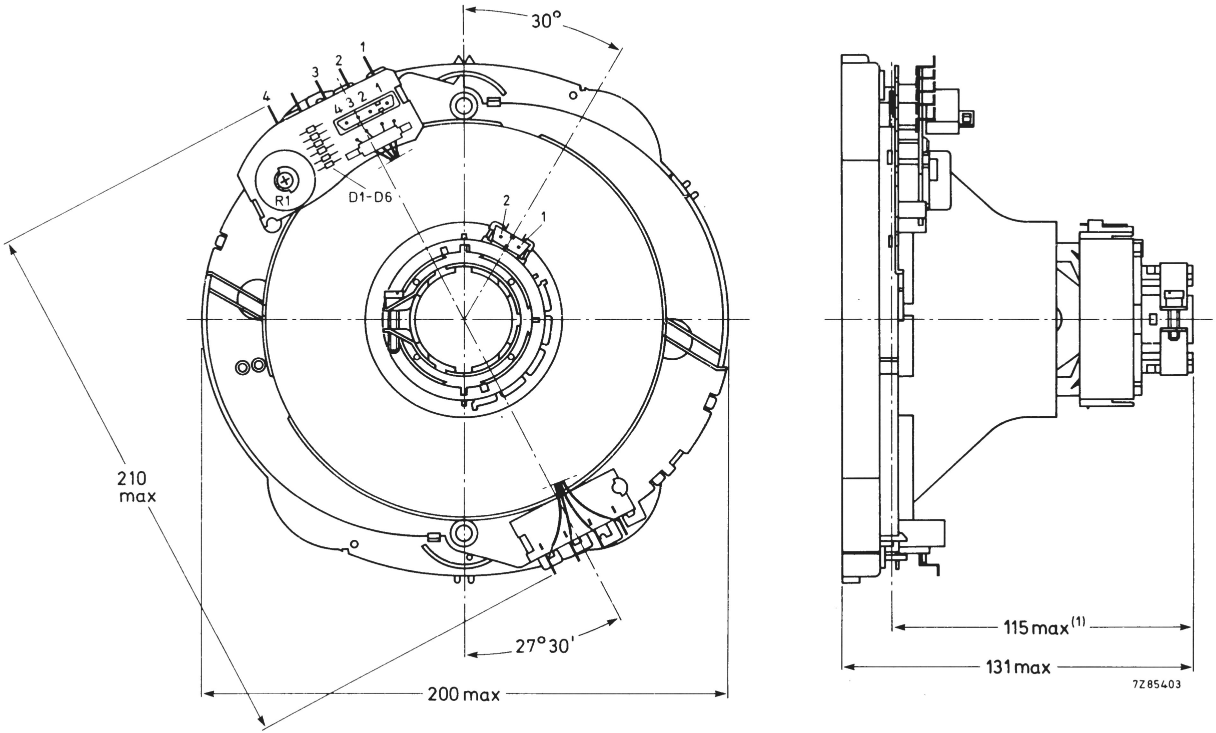
* For details on scan velocity modulation, see Technical Publication

MECHANICAL DATA

Outlines

Dimensions in mm


30°
1
2
3
4
4 3 2 1
R1
D1-D6
2
1
210
max
27°30'
200 max
115 max(1)
131 max
7Z85403

(1) Reference plane of centring bosses.

Fig. 1.

Mounting

The deflection unit can simply be pushed onto the neck of a picture tube.

There are 3 reference surfaces on the neck of the tube and on the deflection unit, to establish angular and axial positioning.

The unit must be pressed against the reference surfaces on the cone of the picture tube with a force of 20 ± 5 N and fixed by tightening the screw in the clamping ring at the rear with a torque of 1,4 Nm. Maximum axial force exerted on the screw is 20 N.

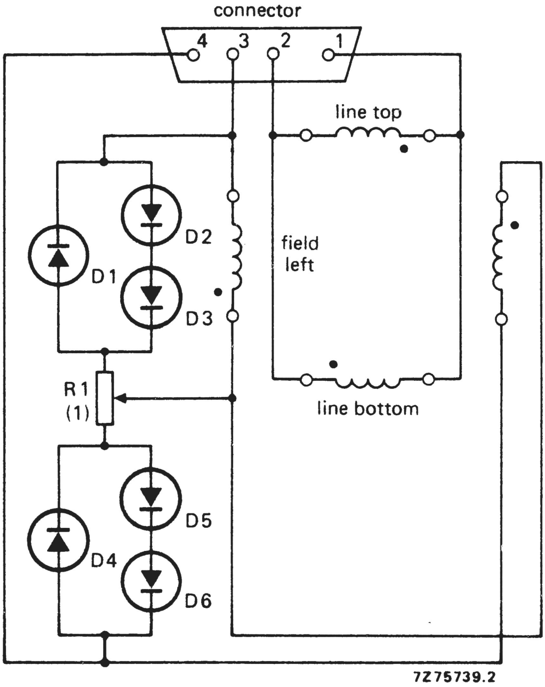
Once the unit is mounted, it is perfectly aligned and requires no further adjustment for static convergence, colour purity and raster orientation.

ELECTRICAL DATA

Deflection coils

Line coils	
inductance	1,5 mH ± 4%
resistance at 25 °C	1,3 Ω ± 10%
Line deflection current edge to edge at 25 kV	5,1 A p-p
Field coils	
inductance	9,7 mH ± 10%
resistance at 25 °C (damping resistance R1 included)	5,85 Ω ± 7%
Field deflection current edge to edge at 25 kV	2,0 A p-p
S.V.M. coils	
inductance	3,7 μH ± 5%
resistance	1,65 Ω ± 10%
sensitivity in x-direction	
at screen centre	2,1 mm/A
on horizontal axis in east and west	4,2 mm/A

Connections


connector
4
3
2
1
line top
D2
D1
D3
field
left
field
right
R1
(1)
line bottom
D5
D4
D6
7Z75739.2

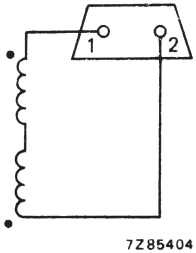


Fig. 3 Diagram of s.v.m. coils. The pin numbering corresponds to that in Fig. 1.
The beginning of the windings is indicated with ●.

Fig. 2 Diagram of deflection coils. The pin numbering corresponds to that in Fig. 1.
(1) R1 is factory adjusted.

D1 to D6 = BAS11, BAX18 or BAX18A.
The beginning of the windings is indicated with ●.

Note
Matching female connector for deflection coils: Stocko MKF 804-1-0-404.
Matching female connector for s.v.m. coils: Stocko MKF 2-802-1-0-202.

ENVIRONMENTAL DATA

Maximum operating temperature	90 °C

DEFLECTION UNITS

- For use with the M37-102X high resolution colour display tube.

QUICK REFERENCE DATA

Intended for display tube with:
gun arrangement — in-line
diagonal — 37 cm
neck diameter — 29,1 mm

Deflection angle — 90°

	AT1331/00	AT1331/10	AT1331/20	AT1331/30
Line deflection current, edge to edge, at 25 kV	4,89 A(p-p)	4,0 A(p-p)	3,54 A(p-p)	2,97 A(p-p)
Inductance of line coils	0,71 mH	1,06 mH	1,36 mH	1,93 mH
Field deflection current, edge to edge, at 25 kV	0,46 A(p-p)	0,70 A(p-p)	0,70 A(p-p)	1,03 A(p-p)
Resistance of field coils	48 Ω	21 Ω	21 Ω	9,6 Ω

APPLICATION

These deflection units are for the 90° high resolution colour display tube M37-102X, with 29,1 mm neck diameter and in-line electron guns. They should be operated in conjunction with a static convergence/colour purity device.

DESCRIPTION

The deflection units are of the hybrid type, with saddle wound line coils and toroidal wound field coils. The line coils are parallel connected, the field coils are series or parallel connected, depending on the type. The units have a non-magnetic metal clamping ring for fixing to the tube neck after axial and rotational alignment.
The deflection units meet the self-extinguishing requirements of IEC and UL.

MECHANICAL DATA

Dimensions in mm

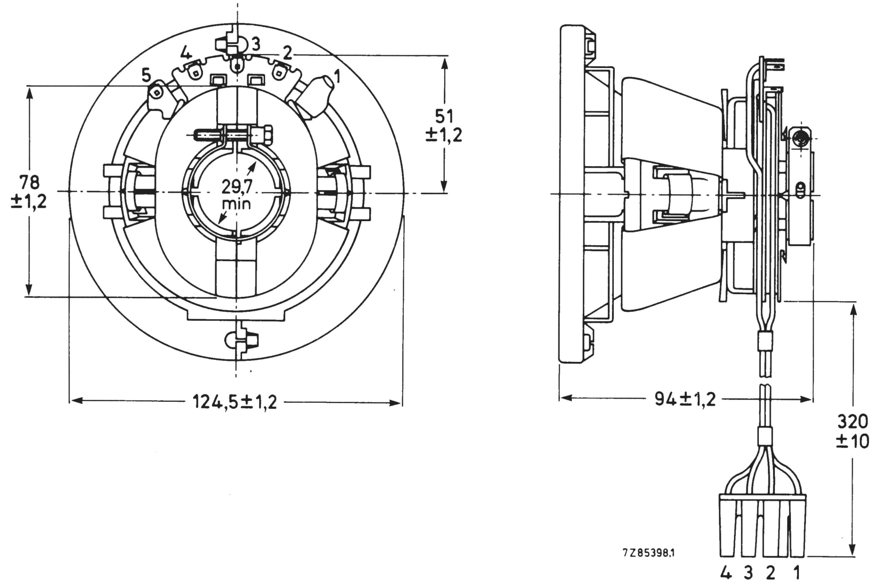


Fig. 1.

Tightening torque on clamping ring: 1,7 Nm.

ELECTRICAL DATA

	AT1331/00	AT1331/10	AT1331/20	AT1331/30
Line deflection coils, see Fig. 2				
Inductance	0,71mH± 3%	1,06 mH ± 3%	1,36 mH ± 3%	1,93 mH ± 3%
Resistance	0,88 Ω ± 10%	1,32 Ω ± 10%	1,69 Ω ± 10%	2,93 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	4,89 A(p-p)	4,0 A(p-p)	3,54 A(p-p)	2,97 A(p-p)
Field deflection coils, see Fig. 3				
Inductance	96 mH ± 10%	42 mH ± 10%	42 mH ± 10%	19,2 mH ± 10%
Resistance	48 Ω ± 10%	21 Ω ± 10%	21 Ω ± 10%	9,6 Ω ± 10%
Field deflection current, edge to edge, at 25 kV	0,46 A(p-p)	0,70 A(p-p)	0,70 A(p-p)	1,03 A(p-p)
Maximum permissible voltage				
across line coils	800 V(p-p)	950 V(p-p)	1100 V(p-p)	1300 V(p-p)
across field coils	100 V(p-p)	100 V(p-p)	100 V(p-p)	100 V(p-p)
between line and field coils	900 V(p-p)	1100 V(p-p)	1200 V(p-p)	1400 V(p-p)
Crosstalk at 16 kHz	−40 dB	−40 dB	−40 dB	−40 dB

Insulation resistance

between line and field coils, at 100 V(d.c.)	100 MΩ
between line coil and core clamping ring, at 500 V(d.c.)	30 MΩ
between field coil and core clamping ring, at 1000 V(d.c.)	100 MΩ

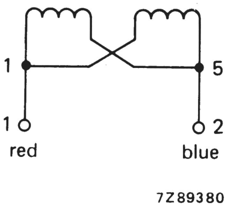


Fig. 2 Diagram of line coils.

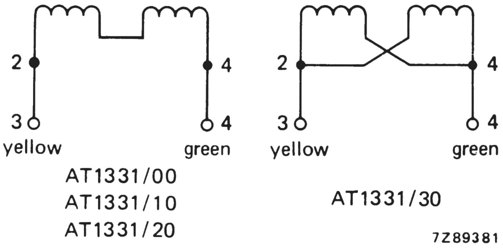


Fig. 3 Diagram of field coils.

DEVELOPMENT SAMPLE DATA

ENVIRONMENTAL DATA

Maximum operating coil temperature	85 °C
Storage temperature range	−20 to + 60 °C
Flammability	according to UL1413 and IEC 65

MOUNTING

The deflection unit must be positioned on the neck of the display tube so that the connecting leads are at the bottom, while the tube is positioned with its anode contact upwards.

After axial and rotational alignment to achieve optimum purity and raster orientation, the unit is fixed by tightening the screw of the clamping ring; the tightening torque is 1,7 Nm. With the unit thus positioned axially, optimum convergence can be achieved in the screen centre with the static convergence magnets, and outside the centre by tilting the unit. Three wedges should be inserted into the remaining gap between the unit and the tube to secure the radial position.

DEFLECTION UNIT

- Raster Correction Free

QUICK REFERENCE DATA

Picture tube	
gun arrangement	in line
diagonal	51 cm (20 in)
neck diameter	29,1 mm
Deflection angle	90°
Line deflection current, edge to edge at 25 kV	3,1 A p-p
Inductance of line coils, parallel connected	1,9 mH
Field deflection current, edge to edge at 25 kV	0,86 A p-p
Resistance of field coils, parallel connected	13,6 Ω

APPLICATION

This deflection unit, in conjunction which devices for colour purity and static convergence is for 90° in-line colour picture tube A51-590X, with a neck diameter of 29,1 mm.
The unit requires no raster correction circuitry.

DESCRIPTION

The deflection unit consists of saddle-shaped line deflection coils, toroidal wound field deflection coils and metal fins, thus forming a raster correction free hybrid yoke. The unit has a metal non-magnetic clamping ring at the rear, to fix the deflection unit on the neck of the picture tube.

MECHANICAL DATA

Dimensions in mm

Outlines

The deflection unit fits a tube with a neck diameter of 29,1 $^{+0,9}_{-0,7}$ mm.

For correct fitting the tube neck should be provided with adhesive tape.

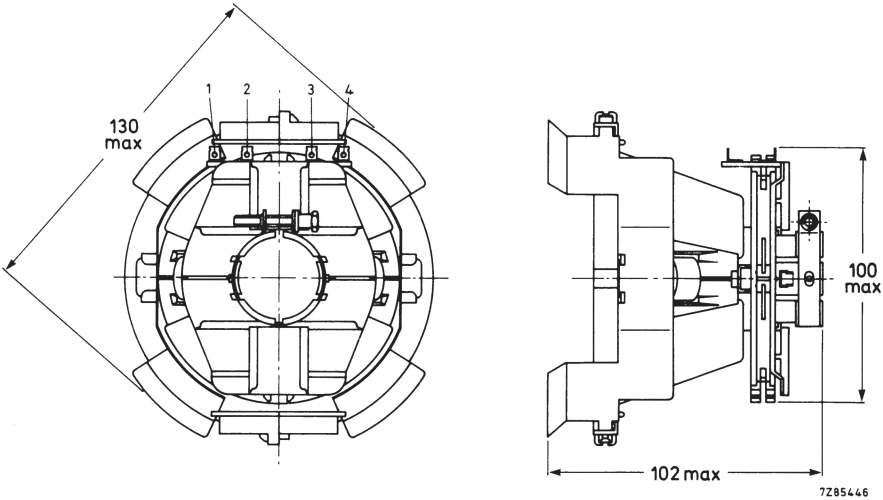


Fig. 1.

Maximum operating temperature (average copper temperature measured with resistance method)	+ 90 °C
Storage temperature range	−20 to + 90 °C
Flame retardent	according to UL 1413, category 94-V1
Torque on neck clamp screw	1,4 Nm

ENVIRONMENTAL TEST SPECIFICATIONS

Vibration	IEC 68-2-6 (test Fc)
Bump	IEC 68-2-29 (test Eb; 35g)
Cold	IEC 68-2-1 (test Ab)
Dry heat	IEC 68-2-2 (test Bb)
Damp heat, steady state	IEC 68-2-3 (test Ca)
Cyclic damp heat	IEC 68-2-30 (test Db)
Change of temperature	IEC 68-2-14 (test Nb)

ELECTRICAL DATA

Line coils	
Inductance at 1 V (r.m.s.), 1 kHz	1,9 mH ± 5%
Resistance at 25 °C	2,2 Ω ± 10%
Line deflection current, edge to edge, at 25 kV	3,1 A(p-p)
Field coils	
Inductance at 1 V (r.m.s.), 1 kHz	29 mH ± 10%
Resistance at 25 °C	13,6 Ω ± 7%
Field deflection current, edge to edge, at 25 kV	0,86 A(p-p)
Cross-talk	a voltage of 10 V, 15 625 Hz applied to the line coils causes no more than 0,2 V across the field coils (damping resistors included)
Insulation resistance at 1 kV (d.c.)	
between line and field coils	> 500 MΩ
between line coil and core clamp	> 500 MΩ
between field coil and core clamp	> 10 MΩ

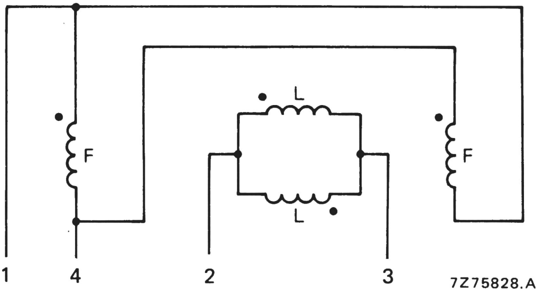


Fig. 2 Connection diagram, L = Line, F = Field.

ADJUSTMENT

- Adjust the static convergence with the four and six-pole magnets of the multipole unit AT1052 for the relative movement of the beams under influence of a four or six-pole magnet.
- Adjust colour purity by axial movement of the deflection yoke and adjustment of the two-pole magnets for centring of the beams.
- Tighten the screw of the clamping ring on the deflection yoke to secure the axial position of the unit on the picture tube.
- Readjust, if necessary, the convergence with the four and six-pole magnets.
- Tilt the unit in either horizontal or vertical direction, or in both directions so that blue, green and red lines converge at the end of the horizontal and vertical axis.
- This position of the unit has to be secured by three rubber wedges placed between the picture tube and the deflection unit. These wedges have to be cemented on to the picture tube.

3122 138 35120

DIODE-SPLIT LINE OUTPUT TRANSFORMER

- **With aluminium foil primary winding**
- **"Piggy-back" type**

QUICK REFERENCE DATA

For transistor line output stages

I_{eht}	max. 1,5 mA
E.H.T.	25 kV
$R_{i(eht)}$	2 MΩ
$I_{p\text{-}p}$ deflection (incl. 6% overscan)	6,5 A
Load inductance (of line deflection coils)	1,12 mH
Supply voltage (V_B')	148 V
Supply current ($I_{average}$) at I_{eht} = 1,5 mA	660 mA
Voltages of primary windings*	+ 105 V p, + 335 V p, + 520 V p
Voltages of auxiliary windings	–335 V p, –160 V p, + 160 V p, + 335 V p, picture tube heater voltage

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 20AX 110° colour picture tubes with a neck diameter of 36,5 mm in transistor equipped television receivers presenting 625 lines at 50 fields per second (CCIR) or 525 lines at 60 fields per second (USA).

It is intended for use in conjunction with:
- deflection unit AT1080, AT1083/01 or AT1085;
- linearity control unit AT4042/38;
- line output transistor BU508A; ←
- a screened e.h.t. cable with a length of 1 m (available under catalogue number 3122 137 58254), as shown in the circuit diagram of Fig. 3.

DESCRIPTION

The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The e.h.t. winding is moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC 65, para. 14.4 and UL492, para. 280-SE1. The transformer is provided with 2 M3 screw-studs for mounting.** External circuit connection is made to connecting pins, positioned as indicated in Fig. 1 enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

---

* D.C. component on these pulses is V_B' (see Fig. 3).

** For mounting on the printed-wiring board a washer of 20 mm in diameter has to be used. Tightening torque on printed-wiring board: 500 + 100 mNm.

MECHANICAL DATA

Dimensions in mm

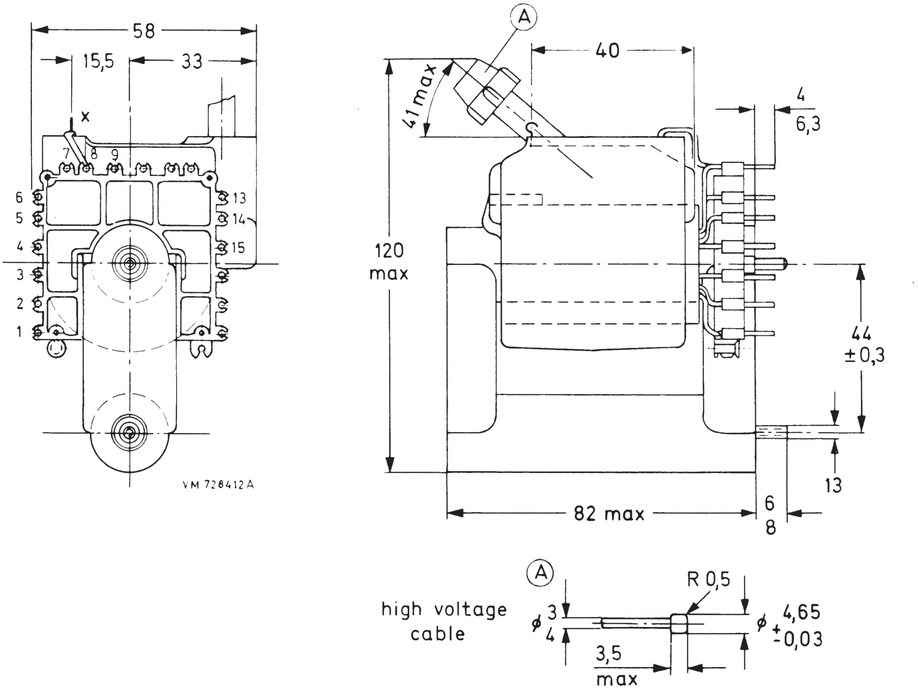

58
15,5
33
x
7
8
9
6
5
4
3
2
1
13
14
15
VM 728412 A
A
40
41 max
4
6,3
120
max
44
±0,3
13
82 max
6
8
A
high voltage
cable
ϕ 3
4
R 0,5
ϕ 4,65
±0,03
3,5
max

Fig. 1.

Mass	500 g approximately
Solderability	in accordance with IEC 68, Test T

MOUNTING

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. The fit of the connecting and the mounting pins in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

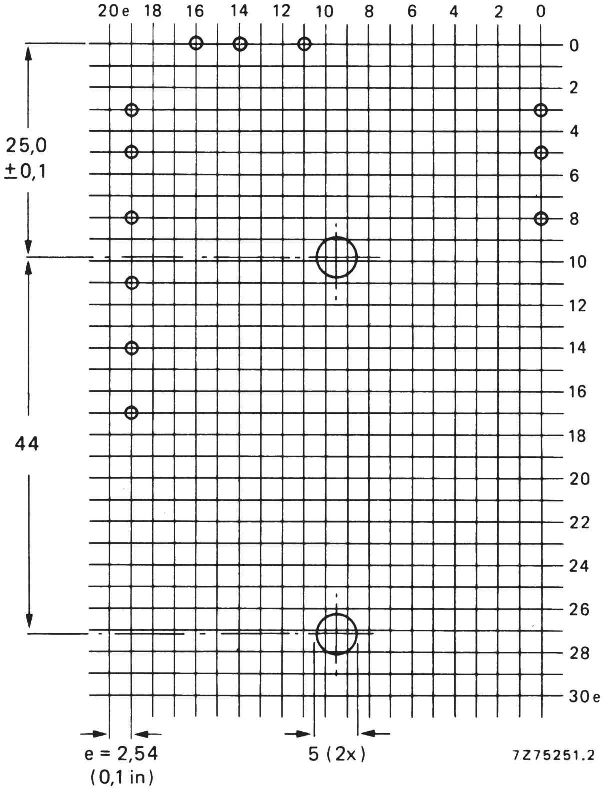


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side). Grid hole diameter 1,3 ± 0,1 mm.

Whether the transformer is board or chassis mounted, the core must be earthed.

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it may be necessary to provide an ample cool air flow around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (it should be noticed that edges of conductive parts must have a greater distance):

From the e.h.t. coil radially, 10 mm
From the e.h.t. coil axially, 10 mm

The transformer, and the leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (measured in circuit of Fig. 3, mains voltage 220 V)

E.H.T. supply	I_{eht}	mA	0,05		1,5
	e.h.t.	kV	25,2		22,6
	$R_{i(eht)}$	MΩ		2,0	
Power supply	V_B	V	163		163
	$V_{B'}$	V	148		141,5
	$I_{average}$	mA	540		760
Output transistor	V_{CEM}	V	1200		1180
	$+I_{CM}$	A	4,1		4,25
Deflection	$I_{p\text{-}p}$ flyback (incl. 6% overscan)	A	6,5		6,2
	$t_{flyback}$	μs	11,3		
	Overscan	%	6		7
V_{focus}		kV	6,3		5,65
Video supply after rectification*		V	233		224
Auxiliary windings: picture tube heater voltage $V_{1\text{-}2}$ (4,67 W)		V	7,6	r.m.s.	7,4
voltages at					
pin 3	V_3	V	−335 p (+ 38 V d.c.)		
pin 4	V_4	V	−160 p		
pin 6	V_6	V	+ 160 p		
pin 7	V_7 **	V	+ 335 p		
pin 9	V_9 **	V	+ 105 p		
pin 14	V_{14}**	V	+ 520 p		

---

* Class-B video stage.

** D.C. component on these pulses is V_B'.

APPLICATION CIRCUIT

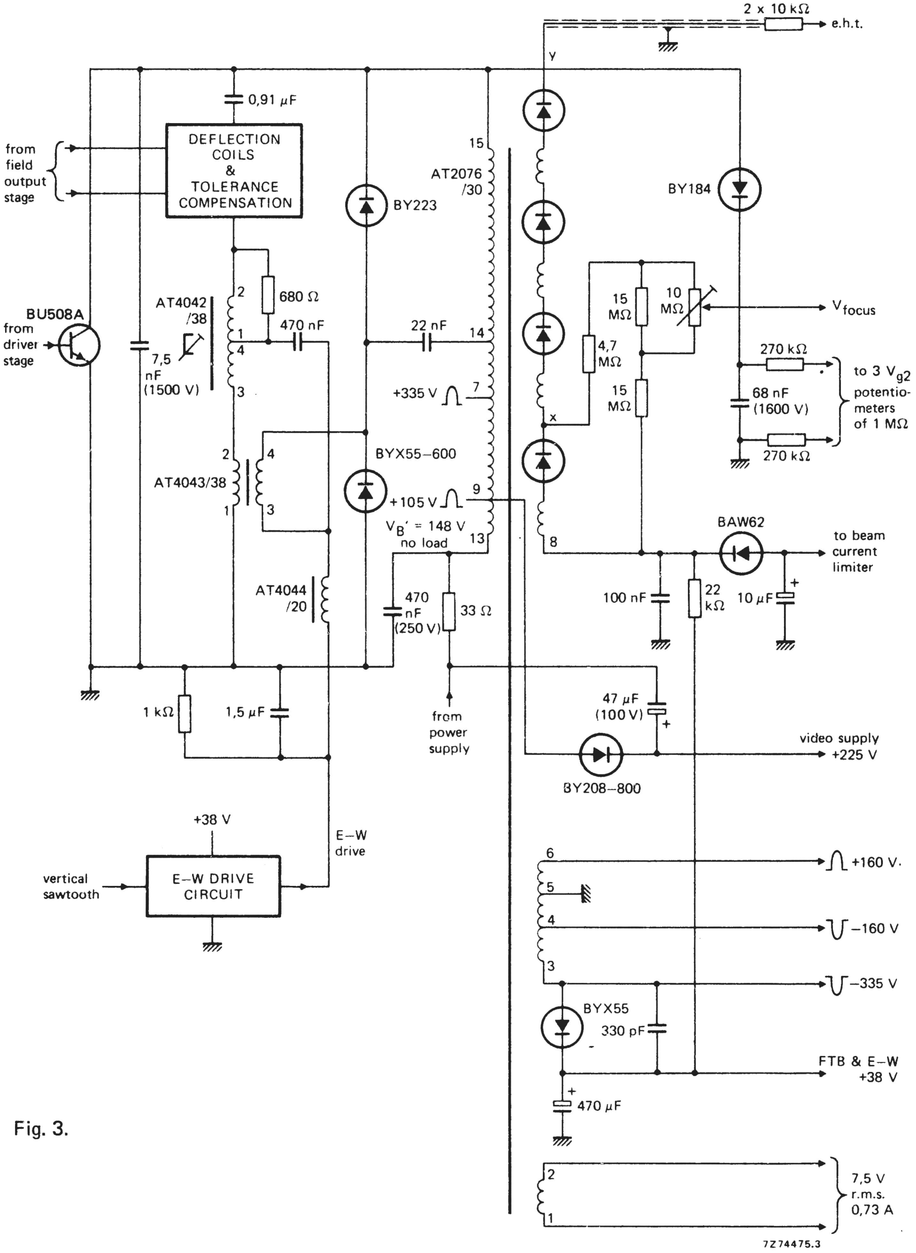

2 x 10 kΩ
e.h.t.
y
0,91 μF
DEFLECTION COILS & TOLERANCE COMPENSATION
from field output stage
15
AT2076 /30
BY223
BY184
BU508A
from driver stage
AT4042 /38
2
680 Ω
1
4
470 nF
22 nF
14
10 MΩ
15 MΩ
V_focus
7,5 nF (1500 V)
3
+335 V
7
4,7 MΩ
15 MΩ
270 kΩ
to 3 V_g2 potentiometers of 1 MΩ
68 nF (1600 V)
270 kΩ
x
2
4
AT4043/38
1
3
BYX55–600
+105 V
9
V_B′ = 148 V no load
13
8
BAW62
to beam current limiter
AT4044 /20
470 nF (250 V)
33 Ω
100 nF
22 kΩ
10 μF
1 kΩ
1,5 μF
from power supply
47 μF (100 V)
video supply +225 V
BY208–800
+38 V
E–W drive
vertical sawtooth
E–W DRIVE CIRCUIT
6
+160 V
5
4
−160 V
3
−335 V
BYX55
330 pF
FTB & E–W +38 V
470 μF
2
1
7,5 V r.m.s. 0,73 A
7Z74475.3

Fig. 3.

DIODE-SPLIT LINE OUTPUT TRANSFORMER

- Three-layer e.h.t. coil, focus tap for hi-bi
- Aluminium foil primary winding
- Piggy-back type
- For Data Graphic Displays

QUICK REFERENCE DATA

For transistor line output stages

deflection angle	110°	90°
I_{eht}	max. 1,5 mA	max. 1 mA
E.H.T.	25 kV	25 kV
$R_{i(eht)}$	1,86 MΩ	2,45 MΩ
$I_{p\text{-}p}$ deflection (incl. 6% overscan)	5,3 A	2,85 A
Supply voltage (V_B')	151 V	151,5 V
Supply current ($I_{average}$) at	477 mA (I_{eht} = 1,5 mA)	291 mA (I_{beam} = 1 mA)
Voltages of primary windings *	V_p = + 114, + 520 + 1060, + 1090	+ 112, + 515 + 1050, + 1080
Voltages of auxiliary windings	V_p = − 280, − 149, + 64, + 227, + 326 picture tube heater voltage	− 275, − 146, + 62 + 223, + 322

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 110° and 90° colour picture tubes in transistor equipped receivers presenting 625 lines at 50 field per second (CCIR) or 525 lines at 60 fields per second (USA).
It is intended for use in conjunction with:

deflection angle	110°	90°
− deflection unit	AT1270/00, AT1260, AT1250	AT1235/00
− bridge coil	AT4043/68	AT4043/68
− linearity control unit	AT4042/42 or /30	AT4042/02
− line output transistor	BU508A	BU508A

− screened e.h.t. cable with a length of 1 m; catalogue number 3122 137 58254.

DESCRIPTION

The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The e.h.t. winding is moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC 65, para. 14.4 and UL492, para. 280-SE1. The transformer has 2 M3 screw-studs for mounting.** External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

---

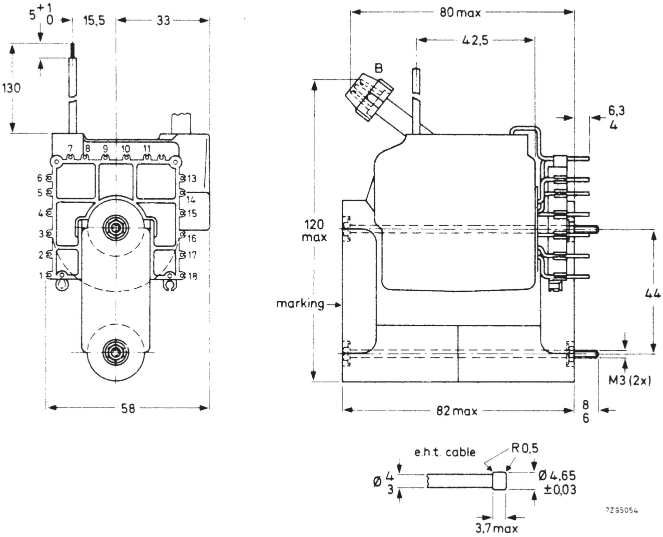
* D.C. component on these pulses is V_B' (see Fig. 3).

** For mounting on the printed-wiring board a washer of 20 mm in diameter has to be used. Tightening torque on printed-wiring board: 500 + 100 mNm.

MECHANICAL DATA

Dimensions in mm

Outlines



5 +1 0
15,5
33
130
7
8
9
10
11
6
5
4
3
2
1
13
14
15
16
17
18
58
80 max
42,5
B
6,3
4
120 max
marking
44
M3 (2x)
82 max
8
6
e.h.t. cable
R 0,5
Ø 4 3
Ø 4,65 ±0,03
3,7 max
7Z65054

Fig. 1.

Solderability in accordance with IEC 68, Test T

MOUNTING

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. The fit of the connecting and the mounting pins in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

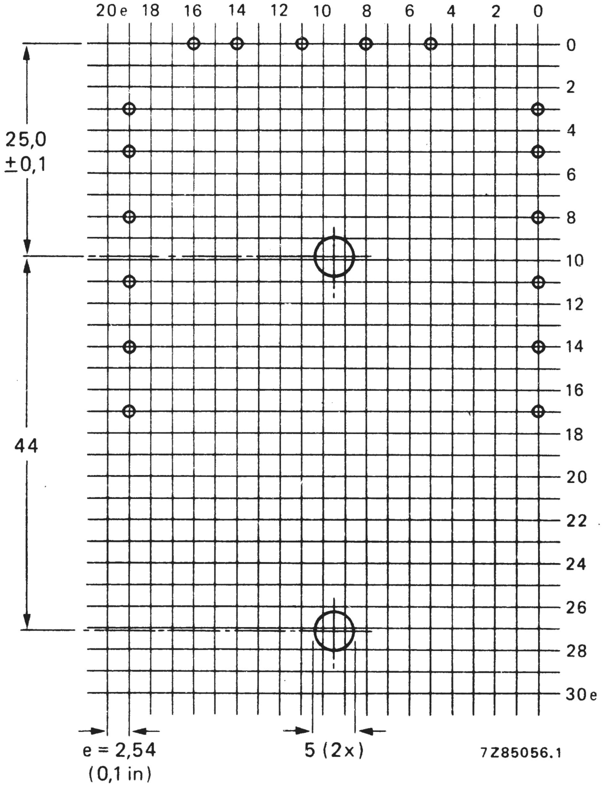


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side). Grid hole diameter 1,3 ± 0,1 mm.

Whether the transformer is board or chassis mounted, **the core must be earthed.**

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it is recommended to provide sufficient flow of cool air around the transformer.

Distances

The following minimum distances between the transformer and **neighbouring conductive flat surfaces** must be maintained:

From the e.h.t. coil radially, 10 mm
From the e.h.t. coil axially, 10 mm

Sharp edges of conductive parts must have greater distances than given above.

The transformer, leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA with 110° COLOUR PICTURE TUBES

E.H.T. supply	I_{eht}	mA	0,03	1	1,5
	e.h.t.	kV	25,0	23,2	22,2
	$R_{i(eht)}$	MΩ		−1,86−	
Power supply	V_B	V	158,5	158,5	158,5
	V_B'	V	151	147,2	145,0
	$I_{average}$	mA	259	397	477
Output transistor	V_{CEM}	V	1240	1210	1190
	$+ I_{CEM}$	A	3,5	3,6	3,65
Deflection	I_{p-p}	A	5,3	5,2	5,15
	$t_{flyback}$	µs	11,4	–	–
	Overscan	%	6	–	6,5
V_{focus}		kV	8,6	8,1	7,8
Auxiliary windings: picture tube heater voltage V_{3-1} (r.m.s.)		V	9,04	8,74	8,54
peak voltages at					
pin 2	V_2	V	−280		
pin 6	V_6	V	−149		
pin 4	V_4	V	+64		
pin 11	V_{11}	V	+227		
pin 8	V_8	V	+326		
pin 9	V_9 *	V	+114		
pin 14	V_{14} *	V	+520		
pin 16	V_{16} *	V	+1060		
pin 17	V_{17} *	V	+1090		

Above measurements using circuits of Figs 3, 4a and 4b.

An alternative 3-diode modulator circuit is shown in Fig. 4c.

---

* D.C. component on these pulses is V_B'.

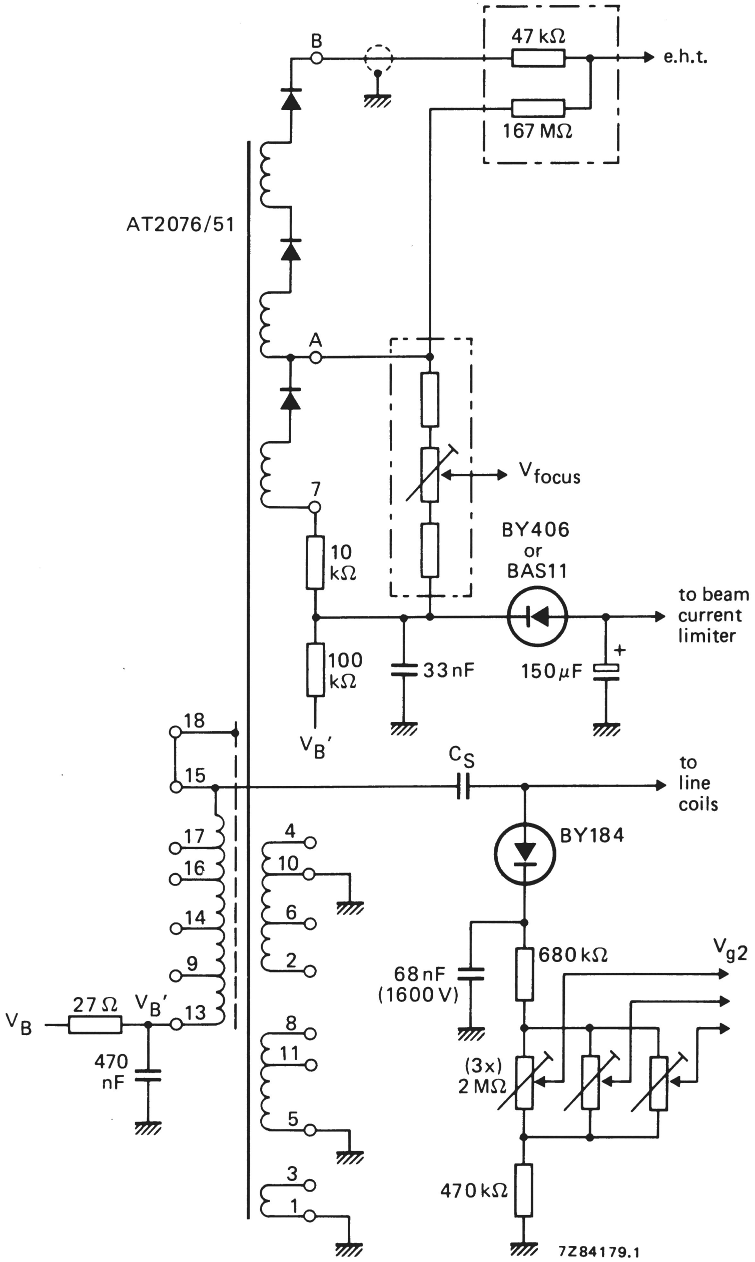

B
47 kΩ
e.h.t.
167 MΩ
AT2076/51
A
V$_{focus}$
7
10 kΩ
BY406 or BAS11
to beam current limiter
100 kΩ
33 nF
150 μF
+
V$_B$'
18
15
C$_S$
to line coils
BY184
17
16
14
9
13
4
10
6
2
8
11
5
3
1
680 kΩ
V$_{g2}$
68 nF (1600 V)
(3x) 2 MΩ
470 kΩ
V$_B$
27 Ω
V$_B$'
470 nF
7Z84179.1

Fig. 3 Circuit diagram of transformer, and e.h.t., focus voltage and V_{g2} circuits.

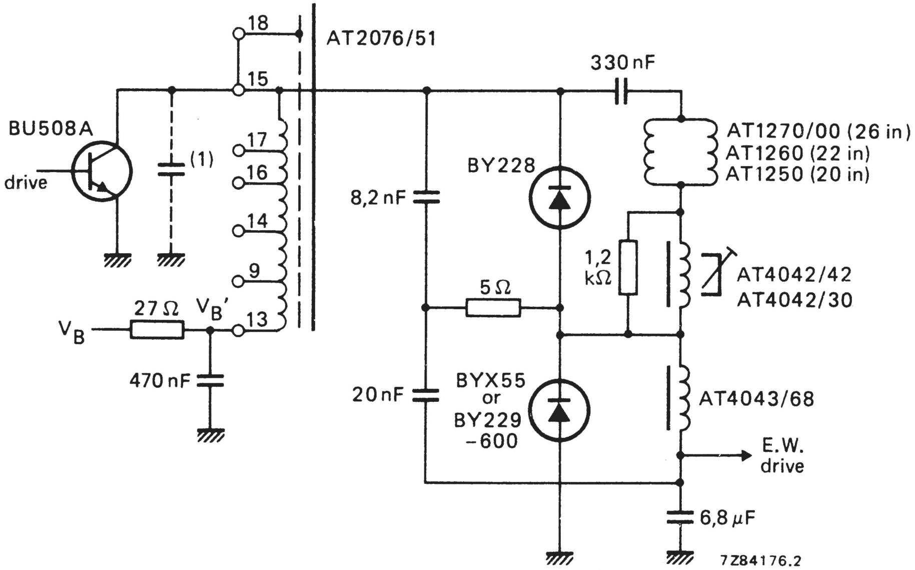

18
15
17
16
14
9
13
AT2076/51
330 nF
BU508A
drive
(1)
8,2 nF
BY228
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2 kΩ
AT4042/42
AT4042/30
5 Ω
27 Ω
V_B'
V_B
470 nF
20 nF
BYX55 or BY229 -600
AT4043/68
E.W. drive
6,8 μF
7Z84176.2

Fig. 4a Diode modulator with split tuning.

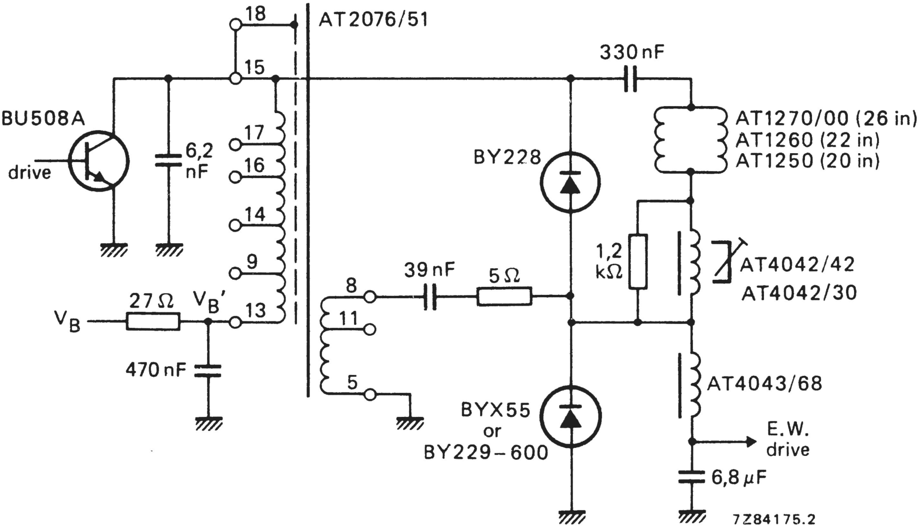

18
15
17
16
14
9
13
AT2076/51
330 nF
BU508A
drive
6,2 nF
BY228
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2 kΩ
AT4042/42
AT4042/30
8
11
5
39 nF
5 Ω
27 Ω
V_B'
V_B
470 nF
BYX55 or BY229-600
AT4043/68
E.W. drive
6,8 μF
7Z84175.2

Fig. 4b Diode modulator with tap on transformer.

(1) Transformer stray capacitance.

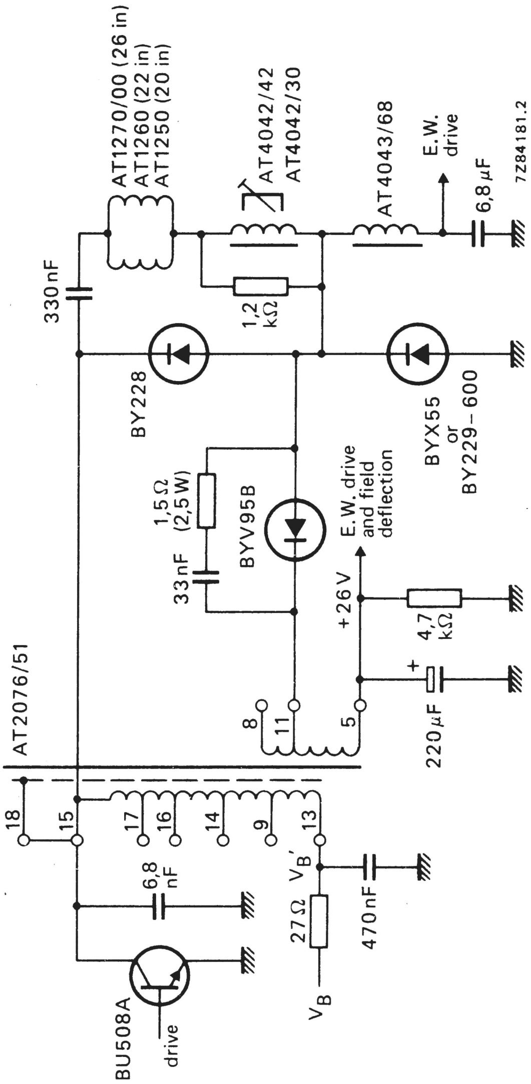

AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
AT4042/42
AT4042/30
AT4043/68
E.W. drive
6,8 μF
7Z84181.2
330 nF
1,2 kΩ
BY228
BYX55 or BY229-600
1,5 Ω (2,5 W)
33 nF
BYV95B
E.W. drive and field deflection
+26 V
4,7 kΩ
AT2076/51
8
11
5
220 μF
+
18
15
17
16
14
9
13
6,8 nF
V_B'
470 nF
27 Ω
V_B
BU508A
drive

Fig. 4c Three-diode modulator circuit.

ELECTRICAL DATA with 90° COLOUR PICTURE TUBES.

			Figs 3 and 5a V_B = 154,5 V		Figs 3 and 5b V_B = 134,3 V	
E.H.T. supply	I_{eht}	mA	0,03	1	0,03	1
	e.h.t.	kV	24,55	22,1	25,0	22,5
	$R_{i(eht)}$	MΩ	–2,45–		–2,5–	
Power supply	V_B'	V	151,5	148,1	130,0	126,1
	$I_{average}$	mA	168	291	226	375
Output transistor	V_{CEM}	V	1220	1150	1060	995
	$+ I_{CEM}$	A	2,0	2,1	2,4	2,5
Deflection	I_{p-p}	A	2,85	2,7	2,9	2,75
	$t_{flyback}$	μs	11,45		11,45	
	Overscan	%	6	7,5	6	7,5
V_{focus}		kV	8,45	7,7	8,6	7,8
Auxiliary windings:						
picture tube heater voltage V_{3-1} (r.m.s.)		V	9,13	8,7	9,30	8,79
peak voltages at						
pin 2	V_2	V	–275		–280	
pin 6	V_6	V	–146		–149	
pin 4	V_4	V	+62		+64	
pin 11	V_{11}	V	+223		+227	
pin 8	V_8	V	+322		+326	
pin 9	V_9 *	V	+112		+114	
pin 14	V_{14} *	V	+515		+520	
pin 15	V_{15} *	V			+1240	
pin 16	V_{16} *	V	+1050			
pin 17	V_{17} *	V	+1080		+1090	

Above measurements using circuits of Figs 3, 5a and 5b.

* D.C. component on these pulses is V_B'.

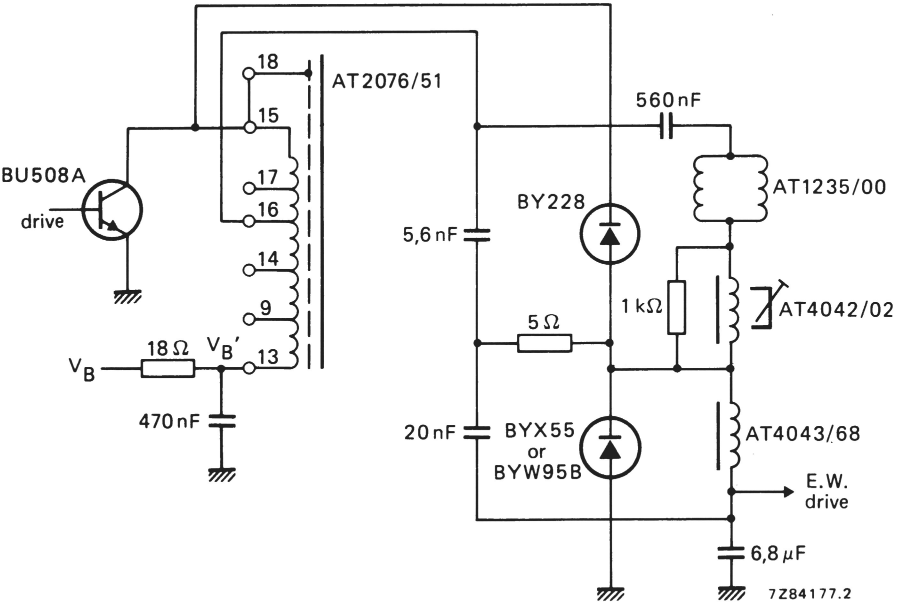

AT2076/51
18
15
17
16
14
9
13
BU508A
drive
18 Ω
V_B'
V_B
470 nF
560 nF
5,6 nF
BY228
AT1235/00
1 kΩ
AT4042/02
5 Ω
20 nF
BYX55
or
BYW95B
AT4043/68
E.W.
drive
6,8 µF
7Z84177.2

Fig. 5a Diode modulator, V_B = 154,5 V.

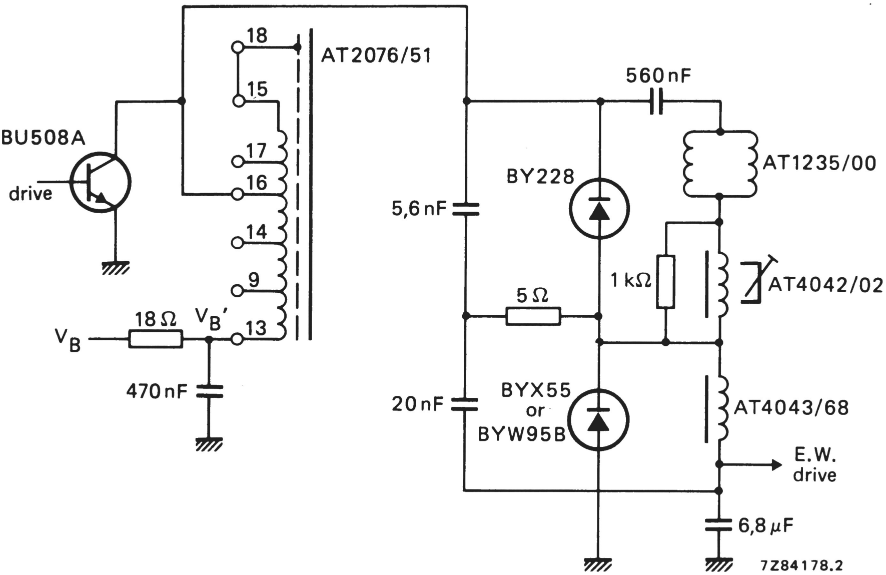

AT2076/51
18
15
17
16
14
9
13
BU508A
drive
18 Ω
V_B'
V_B
470 nF
560 nF
5,6 nF
BY228
AT1235/00
1 kΩ
AT4042/02
5 Ω
20 nF
BYX55
or
BYW95B
AT4043/68
E.W.
drive
6,8 µF
7Z84178.2

Fig. 5b Diode modulator, V_B = 134,3 V.

DIODE-SPLIT LINE OUTPUT TRANSFORMER

- Three-layer e.h.t. coil
- Aluminium foil primary winding
- Piggy-back type
- For Data Graphic Displays.

QUICK REFERENCE DATA

For transistor line output stages

deflection angle	110°	90°
I_{eht}	max. 1,5 mA	max. 1 mA
E.H.T.	25 kV	25 kV
$R_{i(eht)}$	1,86 MΩ	2,45 MΩ
$I_{p\text{-}p}$ deflection (incl. 6% overscan)	5,3 A	2,85 A
Supply voltage (V_B')	151 V	151,5 V
Supply current ($I_{average}$) at	477 mA (I_{eht} = 1,5 mA)	291 mA (I_{beam} = 1 mA)
Voltages of primary windings *	V_p = + 114, + 520 + 1060, + 1090	+ 112, + 515 + 1050, + 1080
Voltages of auxiliary windings	V_p = −280, −149, +64, +227, +326 picture tube heater voltage	−275, −146, +62 +223, +322

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 110° and 90° colour picture tubes in transistor equipped receivers presenting 625 lines at 50 field per second (CCIR) or 525 lines at 60 fields per second (USA).

It is intended for use in conjunction with:

deflection angle	110°	90°
– deflection unit	AT1270/00, AT1260, AT1250	AT1235/00
– bridge coil	AT4043/68	AT4043/68
– linearity control unit	AT4042/42 or /30	AT4042/02 or /04P
– line output transistor	BU508A	BU508A

– screened e.h.t. cable with a length of 1 m; catalogue number 3122 137 58254.

DESCRIPTION

The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The e.h.t. winding is moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC65, para, 14.4 and UL492, para. 280-SE1. The transformer has 2 M3 screw-studs for mounting. ** External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

---

* D.C. component on these pulses is V_B' (see Fig. 3).

** For mounting on the printed-wiring board a washer of 20 mm in diameter has to be used. Tightening torque on printed-wiring board: 500 + 100 mNm.

MECHANICAL DATA

Dimensions in mm

Outlines

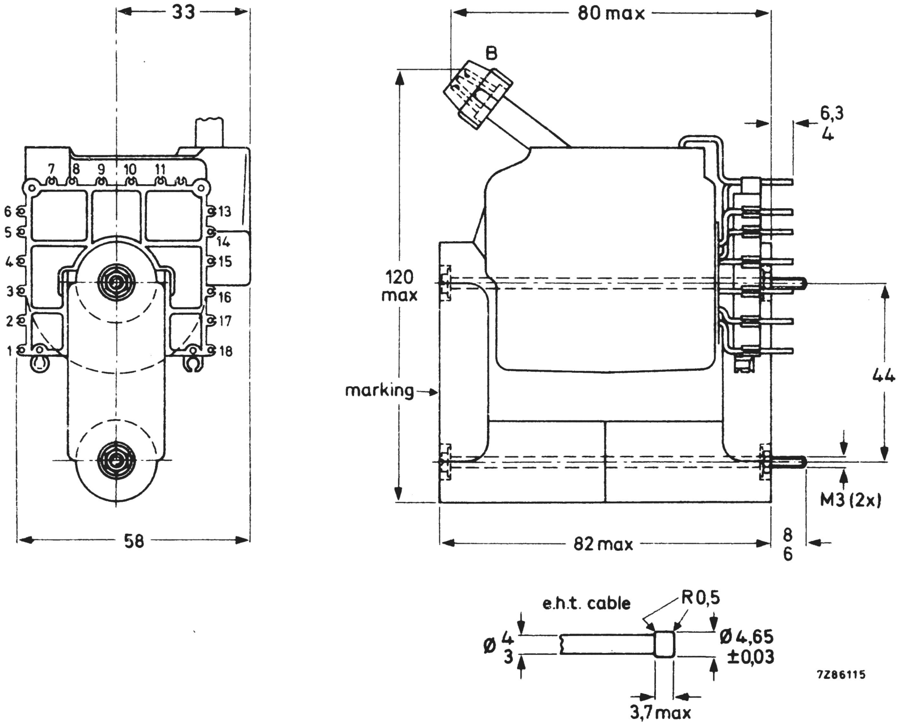

33
58
7
8
9
10
11
6
5
4
3
2
1
13
14
15
16
17
18
80 max
B
6,3
4
120
max
marking
44
M3 (2x)
82 max
8
6
e.h.t. cable
R0,5
Ø 4
3
Ø 4,65
±0,03
3,7 max
7Z86115
B

Fig. 1.

Solderability in accordance with IEC68, Test T

MOUNTING

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. The fit of the connecting and the mounting pins in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

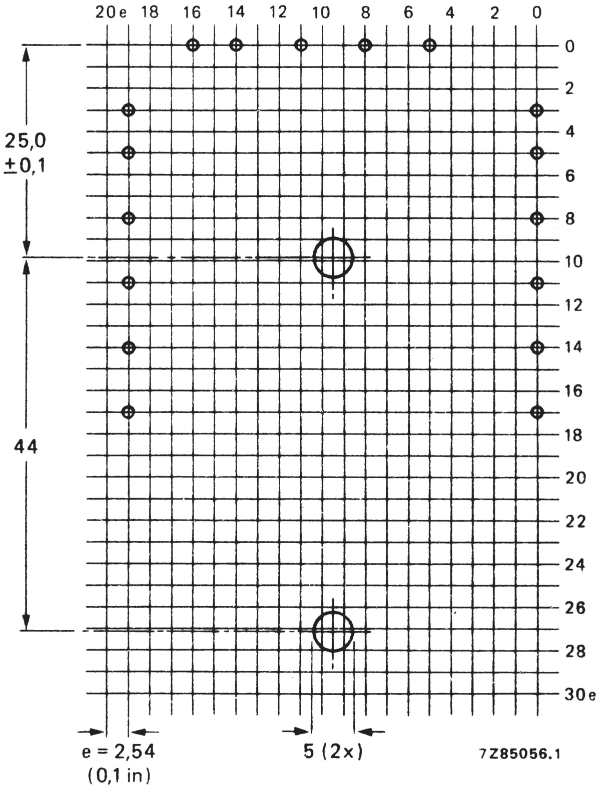


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side). Grid hole diameter 1,3 ± 0,1 mm.

Whether the transformer is board or chassis mounted, **the core must be earthed.**

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it is recommended to provide sufficient flow of cool air around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained:

From the e.h.t. coil radially, 10 mm.
From the e.h.t. coil axially, 10 mm.

Sharp edges of conductive parts must have greater distances than given above.

The transformer, leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA with 110° COLOUR PICTURE TUBES

E.H.T. supply	I_{eht}	mA	0,03	1	1,5
	e.h.t.	kV	25,0	23,2	22,2
	$R_{i(eht)}$	MΩ		−1,86−	
Power supply	V_B	V	158,5	158,5	158,5
	V_B'	V	151	147,2	145,0
	$I_{average}$	mA	259	397	477
Output transistor	V_{CEM}	V	1240	1210	1190
	$+I_{CEM}$	A	3,5	3,6	3,65
Deflection	$I_{p\text{-}p}$	A	5,3	5,2	5,15
	$t_{flyback}$	μs	11,4	–	–
	Overscan	%	6	–	6,5
V_{focus}		kV	8,6	8,1	7,8
Auxiliary windings: picture tube heater voltage $V_{3\text{-}1}$ (r.m.s.)		V	9,04	8,74	8,54
peak voltages at					
pin 2	V_2	V	−280		
pin 6	V_6	V	−149		
pin 4	V_4	V	+64		
pin 11	V_{11}	V	+227		
pin 8	V_8	V	+326		
pin 9	V_9*	V	+114		
pin 14	V_{14}*	V	+520		
pin 16	V_{16}*	V	+1060		
pin 17	V_{17}*	V	+1090		

Above measurements using circuits of Figs 3, 4a and 4b.

An alternative 3-diode modulator circuit is shown in Fig. 4c.

---

* D.C. component on these pulses is V_B'.

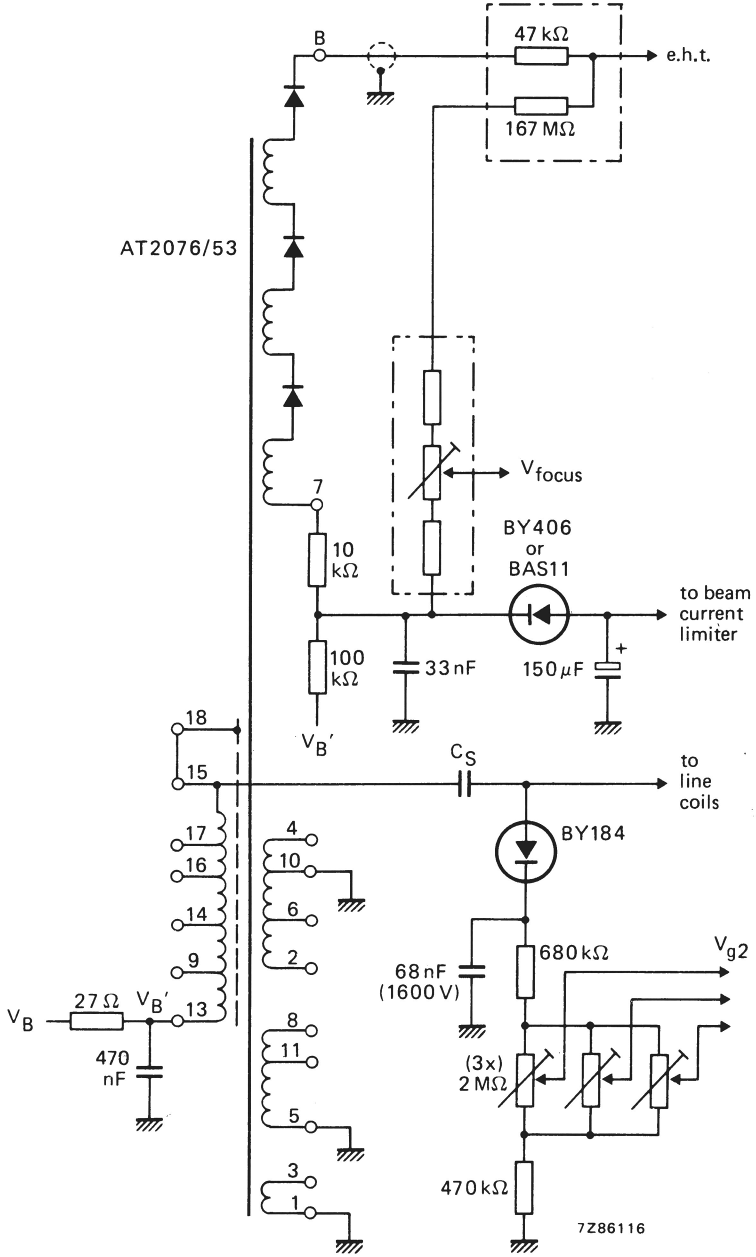

B
47 kΩ
e.h.t.
167 MΩ
AT2076/53
V_focus
7
10 kΩ
BY406 or BAS11
to beam current limiter
100 kΩ
33 nF
150 μF
+
V_B′
18
15
C_S
to line coils
BY184
17
16
14
9
13
4
10
6
2
8
11
5
3
1
68 nF (1600 V)
680 kΩ
V_g2
V_B
27 Ω
V_B′
470 nF
(3x) 2 MΩ
470 kΩ
7Z86116

Fig. 3 Circuit diagram of transformer, and e.h.t., focus voltage and V_{g2} circuits.

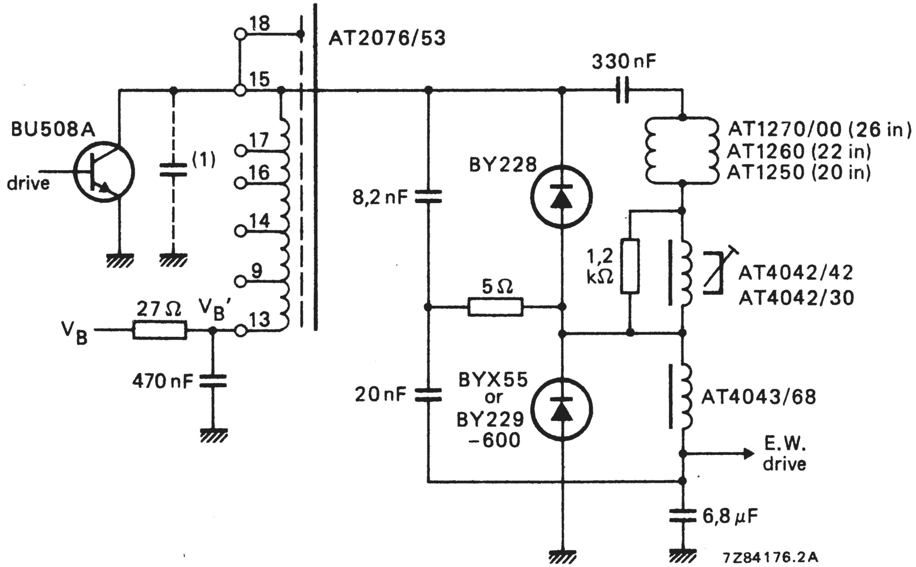

18
15
17
16
14
9
13
AT2076/53
BU508A
drive
(1)
27 Ω
V_B'
V_B
470 nF
8,2 nF
20 nF
5 Ω
BY228
BYX55
or
BY229
−600
330 nF
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2
kΩ
AT4042/42
AT4042/30
AT4043/68
E.W.
drive
6,8 μF
7Z84176.2A

Fig. 4a Diode modulator with split tuning.

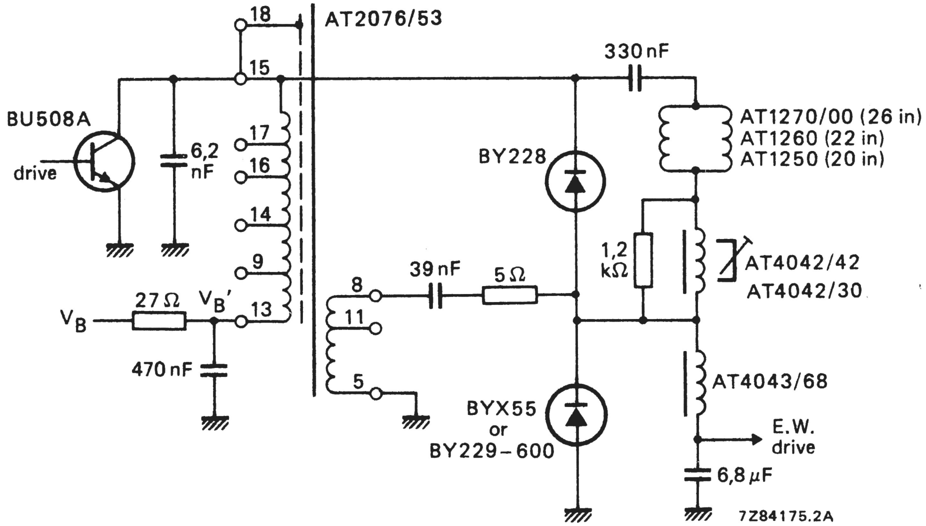

18
15
17
16
14
9
13
AT2076/53
BU508A
drive
6,2
nF
27 Ω
V_B'
V_B
470 nF
8
11
5
39 nF
5 Ω
BY228
BYX55
or
BY229−600
330 nF
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2
kΩ
AT4042/42
AT4042/30
AT4043/68
E.W.
drive
6,8 μF
7Z84175.2A

Fig. 4b Diode modulator with tap on transformer.

(1) Transformer stray capacitance.

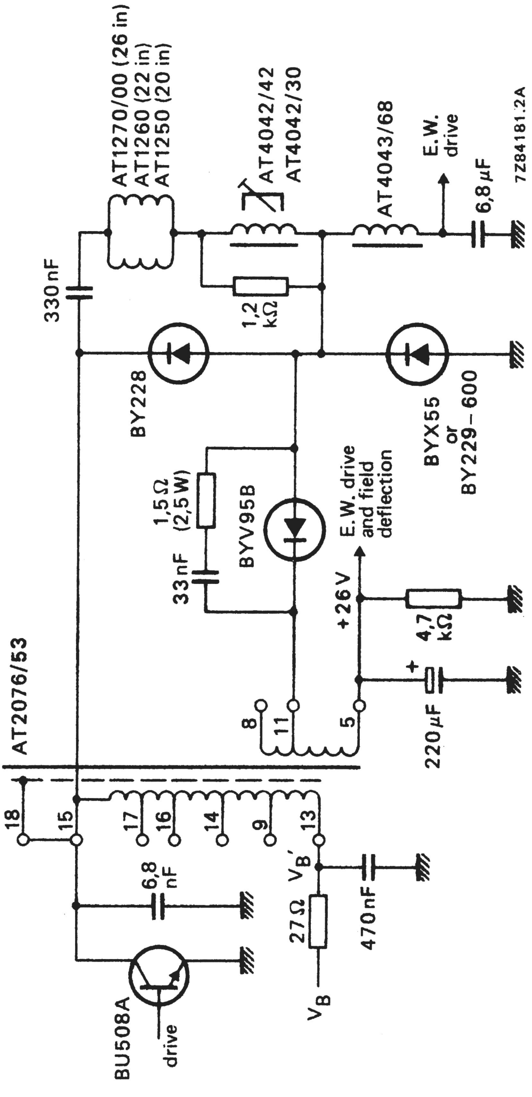

AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
AT4042/42
AT4042/30
AT4043/68
E.W. drive
6,8 μF
7Z84181.2A
330 nF
1,2 kΩ
BY228
BYX55 or BY229-600
1,5 Ω (2,5 W)
33 nF
BYV95B
E.W. drive and field deflection
+26 V
4,7 kΩ
+
220 μF
AT2076/53
8
11
5
18
15
17
16
14
9
13
6,8 nF
V_B'
27 Ω
470 nF
V_B
BU508A
drive

Fig. **4c** Three-diode modulator circuit.

ELECTRICAL DATA with 90° COLOUR PICTURE TUBES

			Figs 3 and 5a V_B = 154,5 V		Figs 3 and 5b V_B = 134,3 V	
E.H.T. supply	I_{eht}	mA	0,03	1	0,03	1
	e.h.t.	kV	24,55	22,1	25,0	22,5
	$R_{i(eht)}$	MΩ	–2,45–		–2,5–	
Power supply	V_B'	V	151,5	148,1	130,0	126,1
	$I_{average}$	mA	168	291	226	375
Output transistor	V_{CEM}	V	1220	1150	1060	995
	$+I_{CEM}$	A	2,0	2,1	2,4	2,5
Deflection	I_{p-p}	A	2,85	2,7	2,9	2,75
	$t_{flyback}$	µs	11,45		11,45	
	Overscan	%	6	7,5	6	7,5
V_{focus}		kV	8,45	7,7	8,6	7,8
Auxiliary windings: picture tube heater voltage V_{3-1} (r.m.s.)		V	9,13	8,7	9,30	8,79
peak voltages at						
pin 2	V_2	V	–275		–280	
pin 6	V_6	V	–146		–149	
pin 4	V_4	V	+62		+64	
pin 11	V_{11}	V	+223		+227	
pin 8	V_8	V	+322		+326	
pin 9	V_9*	V	+112		+114	
pin 14	V_{14}*	V	+515		+520	
pin 15	V_{15}*	V			+1240	
pin 16	V_{16}*	V	+1050			
pin 17	V_{17}*	V	+1080		+1090	

Above measurements using circuits of Figs 3, 5a and 5b.

---

* D.C. component on these pulses is V_B'.

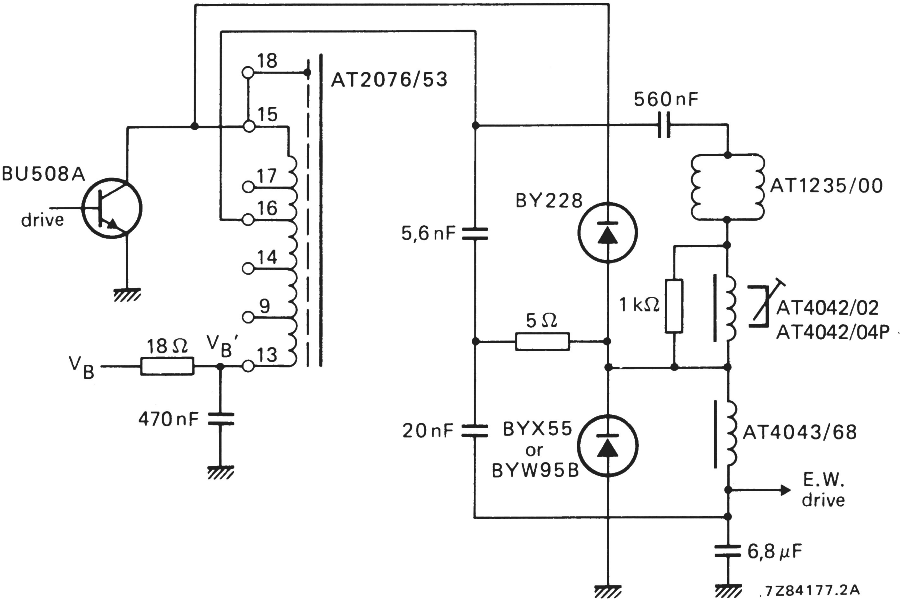

BU508A
drive
18
15
17
16
14
9
13
AT2076/53
18 Ω
V_B'
V_B
470 nF
560 nF
5,6 nF
BY228
5 Ω
20 nF
BYX55
or
BYW95B
AT1235/00
1 kΩ
AT4042/02
AT4042/04P
AT4043/68
E.W.
drive
6,8 μF
7Z84177.2A

Fig. 5a Diode modulator, V_B = 154,5 V.

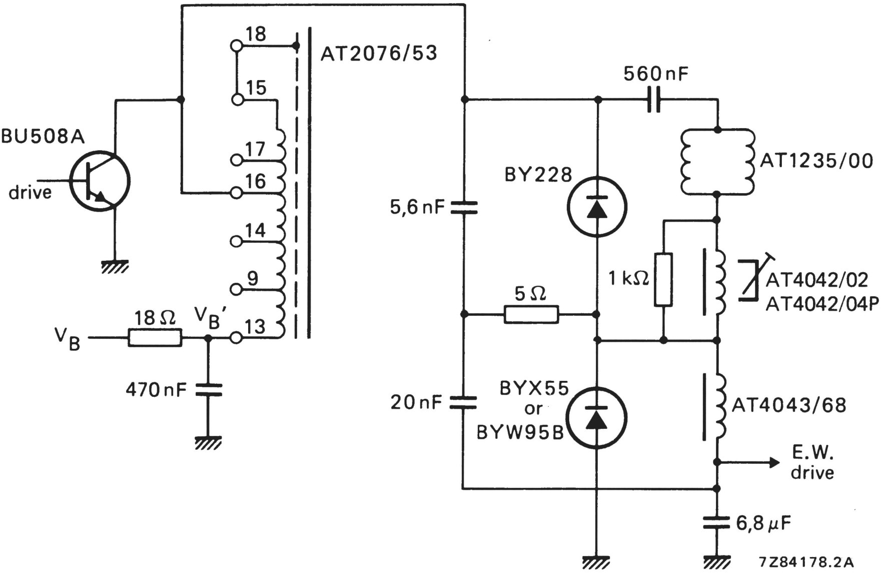

BU508A
drive
18
15
17
16
14
9
13
AT2076/53
18 Ω
V_B'
V_B
470 nF
560 nF
5,6 nF
BY228
5 Ω
20 nF
BYX55
or
BYW95B
AT1235/00
1 kΩ
AT4042/02
AT4042/04P
AT4043/68
E.W.
drive
6,8 μF
7Z84178.2A

Fig. 5b Diode modulator, V_B = 134,3 V.

3122 138 35880

SYNCHRONOUS POWER PACK TRANSFORMER

for colour television

- piggy-back type
- mains isolation
- aluminium foil primary winding and screens

QUICK REFERENCE DATA

E.H.T.	25 kV ± 3%
I_{eht}	max. 1,6 mA
$R_{i(eht)}$	1 MΩ
V_x (see Fig. 3)	6,25 kV
Supply	
voltage d.c.	+ 292 V
current (I_{eht} = 1,5 mA)	345 mA
Voltages of auxiliary windings	
r.m.s.	3,8 V, 8 V
d.c.	8 V, 18 V, 24 V, 33 V, 147 V, 225 V

APPLICATION

This transformer has been designed for use as a mains isolated supply transformer in colour television sets. It provides the required stabilized auxiliary voltages including an e.h.t. supply with low internal resistance. The transformer is suitable for 90° and 110° deflection systems using 25 kV e.h.t. It is intended for use in conjunction with:

- mains filter choke AT4043/55;
- mains transformer TS561/2;
- current sensing transformer AT4043/46;
- driver transformer AT4043/45;
- supply choke AT4043/52;

and for 110° 20, 22 and 26 inch tubes:

- deflection unit AT1270, AT1260 and AT1250;
- line choke AT4043/53;
- linearity control unit AT4042/41;
- line driver transformer AT4043/87 (if separate drive of line output stage is required);

and for 90° 20 inch tubes:

- deflection unit AT1235/00;
- line choke AT4043/53;
- linearity control unit AT4042/02.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores screwed together. The primary winding of aluminium foil with screens and the e.h.t. winding with incorporated diodes are moulded in flame retarding polyester.

The device is provided with two securing M3 studs. External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

MECHANICAL DATA

Dimensions in mm

Outlines

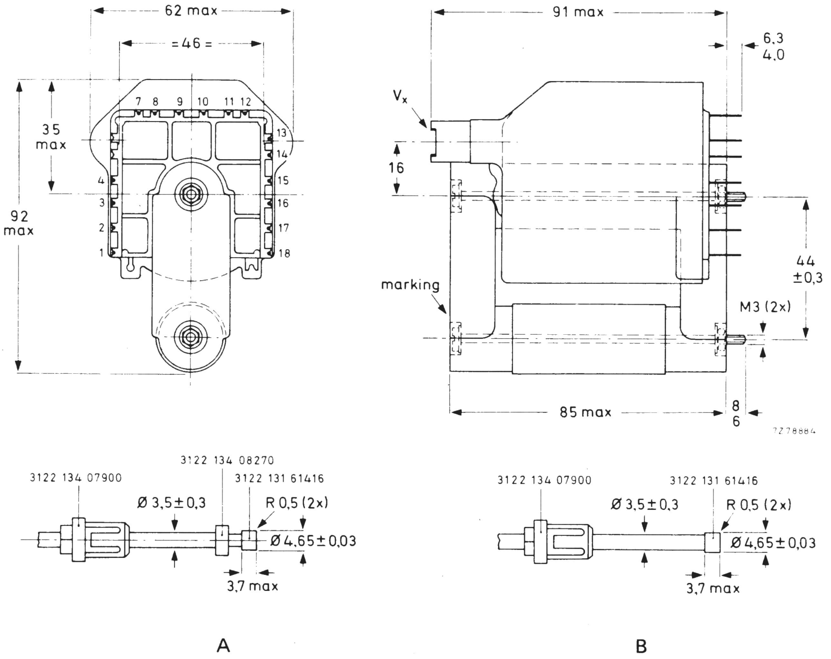

62 max
=46=
35 max
92 max
7 8 9 10 11 12
13 14 15 16 17 18
4 3 2 1
91 max
6,3
4,0
Vx
16
44 ±0,3
M3 (2x)
marking
85 max
8
6
7Z78884
3122 134 07900
3122 134 08270
3122 131 61416
Ø 3,5 ± 0,3
R 0,5 (2x)
Ø 4,65 ± 0,03
3,7 max
A
3122 134 07900
3122 131 61416
Ø 3,5 ± 0,3
R 0,5 (2x)
Ø 4,65 ± 0,03
3,7 max
B

Fig. 1 A is plug for connection to V_X, B is plug for connection to e.h.t.

Mass	530 g
Solderability	max. 240 °C, max. 2,5 s

Mounting

The transformer may be mounted on either a printed-wiring board or, on a metal chassis. Two securing studs (M3) are provided. For mounting on a printed-wiring board, a washer of 20 mm outer diameter has to be used. Tightening torque on printed-wiring board: 500 + 100 mNm. The fit of the connecting pins and the studs in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

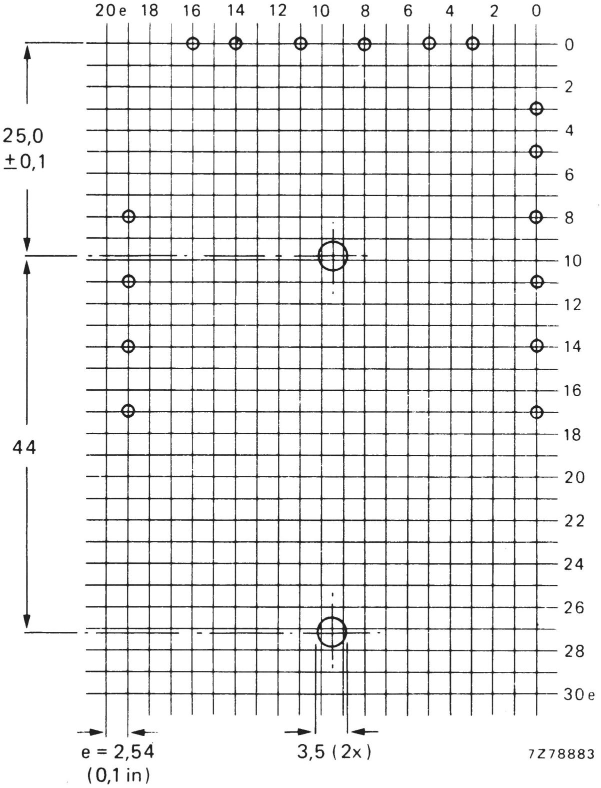


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side). Grid hole diameter 1,3 ± 0,1 mm.

Whether the transformer is board or chassis mounted, the core must be earthed.

Temperature

The ambient temperature in the set should not exceed + 65 °C under worst conditions, i.e. taking into account:

- maximum output power;
- maximum supply voltage;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it may be necessary to provide an ample cool air flow around the transformer.

Distances

The following minimum distances between the transformer and neighbouring **conductive flat surfaces** must be maintained (it should be noted that edges of conductive parts must have a greater distance):

from the e.h.t. coil, radially 10 mm, axially 10 mm.

The transformer, and the leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (measured in circuit of Fig. 3, mains voltage 220 V)

E.H.T. supply	I_{eht}	mA	0,15	1,6
	e.h.t.	kV	25,2	23,7
	$R_{i(eht)}$	MΩ	1,0	
Power supply	V_B *	V	297	292
	$I_{average}$	mA	230	345
V_o prim.		V	150	150,5
Supply transistor (BU208A)	V_{CEM}	V	1250	1260
	$+I_{CM}$	A	2,8	3,1
Flyback time		µs	14,8	15,0
V_x		kV	6,25	—
Auxiliary windings (typical value):				
picture tube heater voltage	V_{18} (r.m.s.)	V	7,7 (720 mA)	
drive winding	V_{15-17} (r.m.s.)	V	3,8 (1 A)	
Voltages after rectification, pins 10 and 11 to earth:				
field time base	V_8	V	33 (310 mA)	
line time base	V_9	V	147 (140 mA)	
	V_{12}	V	8 (97 mA)	
video output	V_{13}	V	225 (10 mA)	
audio output	V_{14}	V	24	
audio output	V_{16}	V	18 (700 mA)	

Note: The power pack is capable of supplying 45 W extra output power if required, e.g. higher audio output power from pin 14.

---

* Stabilization range V_B from 215 V d.c. (165 V mains) to 350 V d.c. (265 V mains).

APPLICATION CIRCUIT

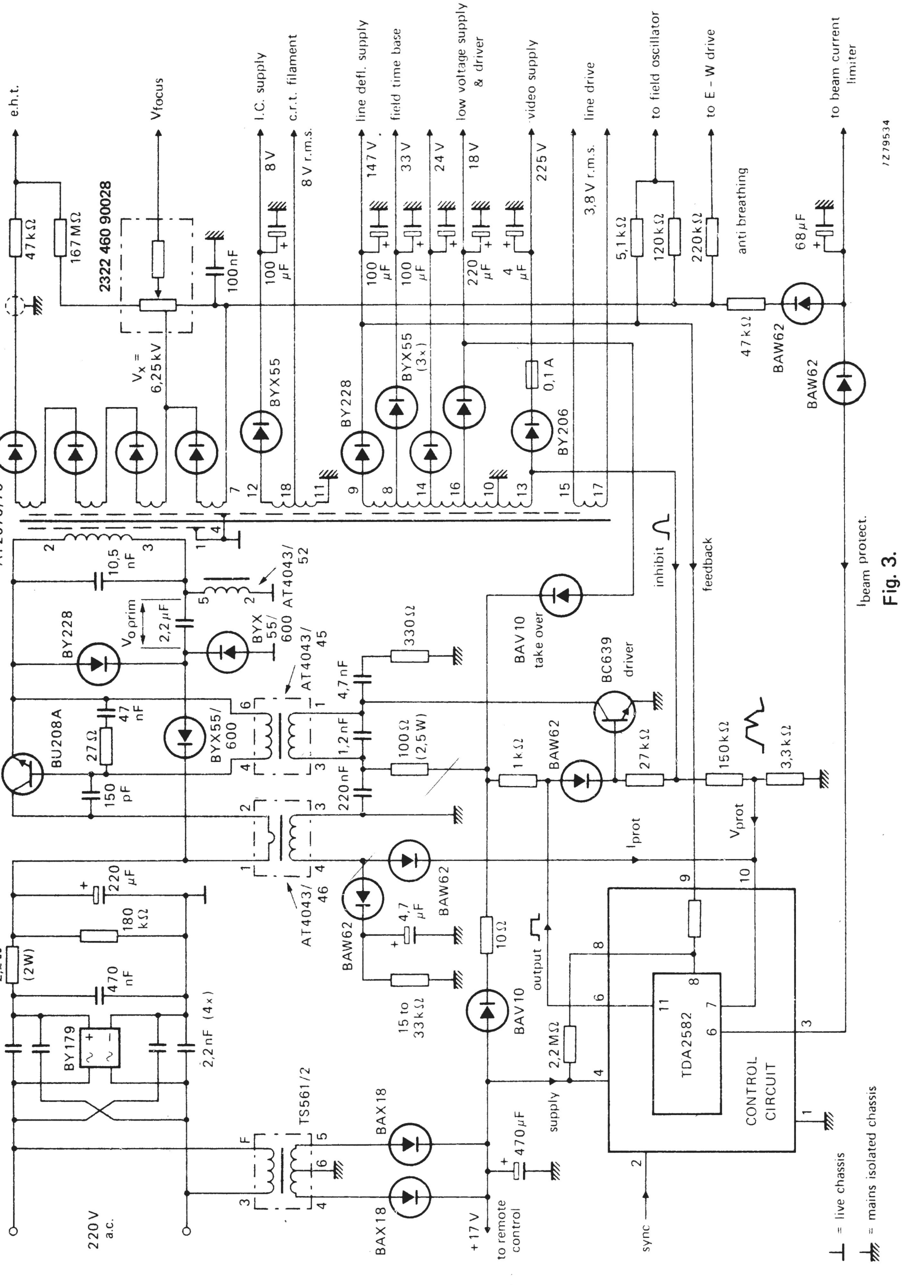

e.h.t.
Vfocus
I.C. supply
c.r.t. filament
line defl. supply
field time base
low voltage supply & driver
video supply
line drive
to field oscillator
to E - W drive
to beam current limiter
7Z79534
8 V
8 V r.m.s.
147 V
33 V
24 V
18 V
225 V
3,8 V r.m.s.
47 kΩ
167 MΩ
2322 460 90028
100 nF
100 µF
100 µF
100 µF
220 µF
4 µF
5,1 kΩ
120 kΩ
220 kΩ
anti breathing
68 µF
47 kΩ
BAW62
BAW62
Vx = 6,25 kV
BYX55
BY228
BYX55 (3×)
0,1 A
BY206
AT2076/70
7
12
18
11
9
8
14
16
10
13
15
17
2
3
4
1
10,5 nF
5
2
AT4043/52
inhibit
feedback
Ibeam protect.
BY228
Vo prim
2,2 µF
BYX 55/600
AT4043/45
BAV10 take over
330 Ω
4,7 nF
BC639 driver
BU208A
27 Ω
47 nF
6
4
BYX55/600
1
3
1,2 nF
100 Ω (2,5 W)
1 kΩ
BAW62
27 kΩ
150 kΩ
3,3 kΩ
150 pF
220 nF
2
3
Iprot
Vprot
1
4
AT4043/46
220 µF
180 kΩ
2,2 Ω (2W)
470 nF
BY179
2,2 nF (4×)
BAW62
4,7 µF
BAW62
15 to 33 kΩ
10 Ω
BAV10
output
9
10
8
6
11
8
7
6
3
TDA2582
CONTROL CIRCUIT
2,2 MΩ
4
supply
1
2
sync
TS561/2
F
5
6
3
4
BAX18
BAX18
470 µF
+17 V
to remote control
220 V a.c.
= live chassis
= mains isolated chassis

Fig. 3.

MINIATURE DIODE-SPLIT LINE OUTPUT TRANSFORMER

- Three-layer e.h.t. coil, focus tap for hi-bi
- Aluminium foil primary winding
- Simplified synchronous power pack system
- Raster correction free

QUICK REFERENCE DATA

For transistor line output stages; 90° deflection angle

I_{eht}	0 mA	0,6 mA
E.H.T.	23,0 kV	21,2 kV
$R_{i(eht)}$	2,6 MΩ	
$I_{p\text{-}p}$ deflection	3,2 A	3,12 A
Supply voltage (V_B)	111 V	109,6 V
Supply current ($I_{average}$)	350 mA	460 mA
Auxiliary voltages	7,9 V(r.m.s.), −500 V(p-p), −420 V(p-p), −210 V(p-p), −124 V(p-p), −14 V(p-p), +28 V(p-p), +210 V(p-p), +440 V(p-p)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 90° colour picture tubes in transistor or gate turn-off thyristor equipped television receivers presenting 625 lines at 50 fields per second (CCIR) or 525 lines at 60 fields per second (USA). The transformer may also be used in colour monitors.

It is intended for use in conjunction with:

- deflection unit AT1206/20, AT1216/20 or AT1236/20,
- input choke AT4043/81;
- driver transformer AT4043/82;
- sensing transformer AT4043/46;
- line output transistor BU508A, or
- fast gate turn-off thyristor BTW58;
- screened e.h.t. cable, length 1 m; catalogue number 3122 137 62300;
- focus cable, length 31 cm; catalogue number 3122 131 00732.

Note: Types AT2076/80 and AT2076/80A differ only in manufacturing technique; apart from this the transformers are identical.

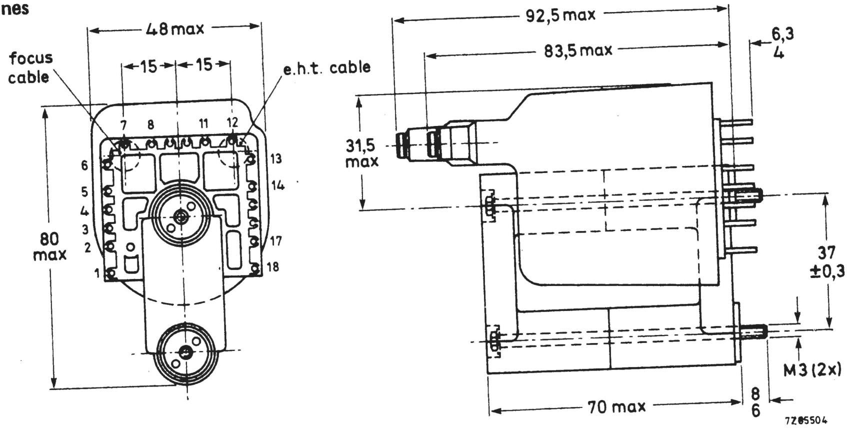
DESCRIPTION

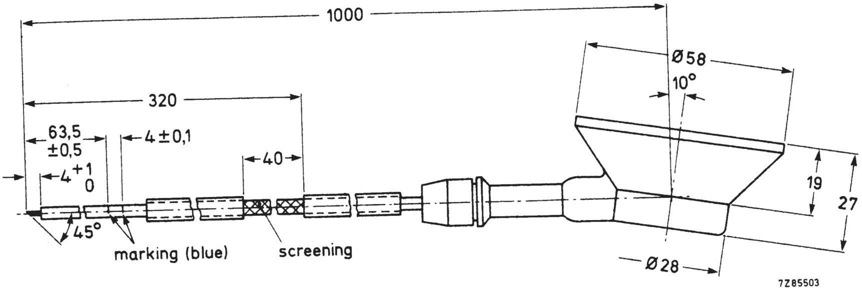
The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The primary winding together with its e.h.t. winding are moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC 65, para. 14.4 and UL492, para. 280-SE1. The transformer has 2 M3 screw-studs for mounting. External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

Dimensions in mm

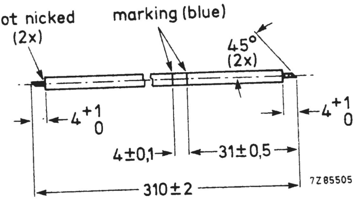
MECHANICAL DATA

Outlines


48 max
15
15
focus cable
e.h.t. cable
7
8
11
12
6
5
4
3
2
1
13
14
17
18
80 max
92,5 max
83,5 max
6,3
4
31,5 max
37 ±0,3
M3 (2x)
8
6
70 max
7Z85504


1000
Ø58
10°
320
63,5 ±0,5
4 ±0,1
40
4 +1 0
45°
marking (blue)
screening
19
27
Ø28
7Z85503

e.h.t. cable


not nicked (2x)
marking (blue)
45° (2x)
4 +1 0
4 +1 0
4±0,1
31±0,5
310±2
7Z85505

focus cable

Fig. 1.

Mass	325 g
Solderability	in accordance with IEC 68, test T

Mounting

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. For mounting on a printed-wiring board a washer of 20 mm outer diameter has to be used; the tightening torque of the printed-wiring board is 500 + 100 mNm. The fit of the connecting pins and the studs in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

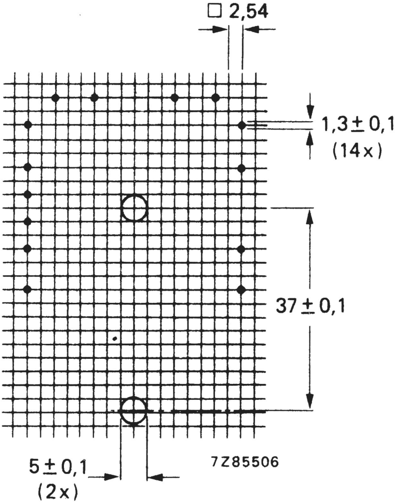


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Whether the transformer is board or chassis mounted, **the core must be earthed.**

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it is recommended to provide sufficient flow of cool air around the transformer.

Distances

The following minimum distances between the transformer and **neighbouring conductive flat surfaces** must be maintained:

From the e.h.t. coil radially, 10 mm
From the e.h.t. coil axially, 10 mm

Sharp edges of conductive parts must have greater distances than given above.

The transformer, leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops, etc.

ELECTRICAL DATA with 90° COLOUR PICTURE TUBES

E.H.T. supply	I_{eht}	mA	0	0,6
	e.h.t.	kV	23,0	21,2
	$R_{i(eht)}$	MΩ	2,6	
Power supply	V_B	V	111	109,6
	$I_{average}$	mA	350	460
Output transistor	V_{CEM}	V	1285	1280
	$+ I_{CEM}$	A	2,95	2,95
Deflection	$I_{p\text{-}p}$	A	3,2	3,12
	$t_{flyback}$	μs	12,0	12,0
	Overscan	%	6	–
V_{focus}		kV	7,65	7,05
Auxiliary windings:				
picture tube heater voltage (r.m.s. value)		V	7,97	7,72
Voltages (peak-to-peak values) at				
pin 1	V_1	V	+440	
pin 17	V_{17}	V	–420	
pin 6	V_6	V	–500	
pin 2	V_2	V	–210	
pin 5	V_5	V	–124	
pin 8	V_8	V	+28	
pin 4	V_4	V	+210	
pin 14	V_{14}	V	–14	

Above measurements using circuit of Fig. 3.

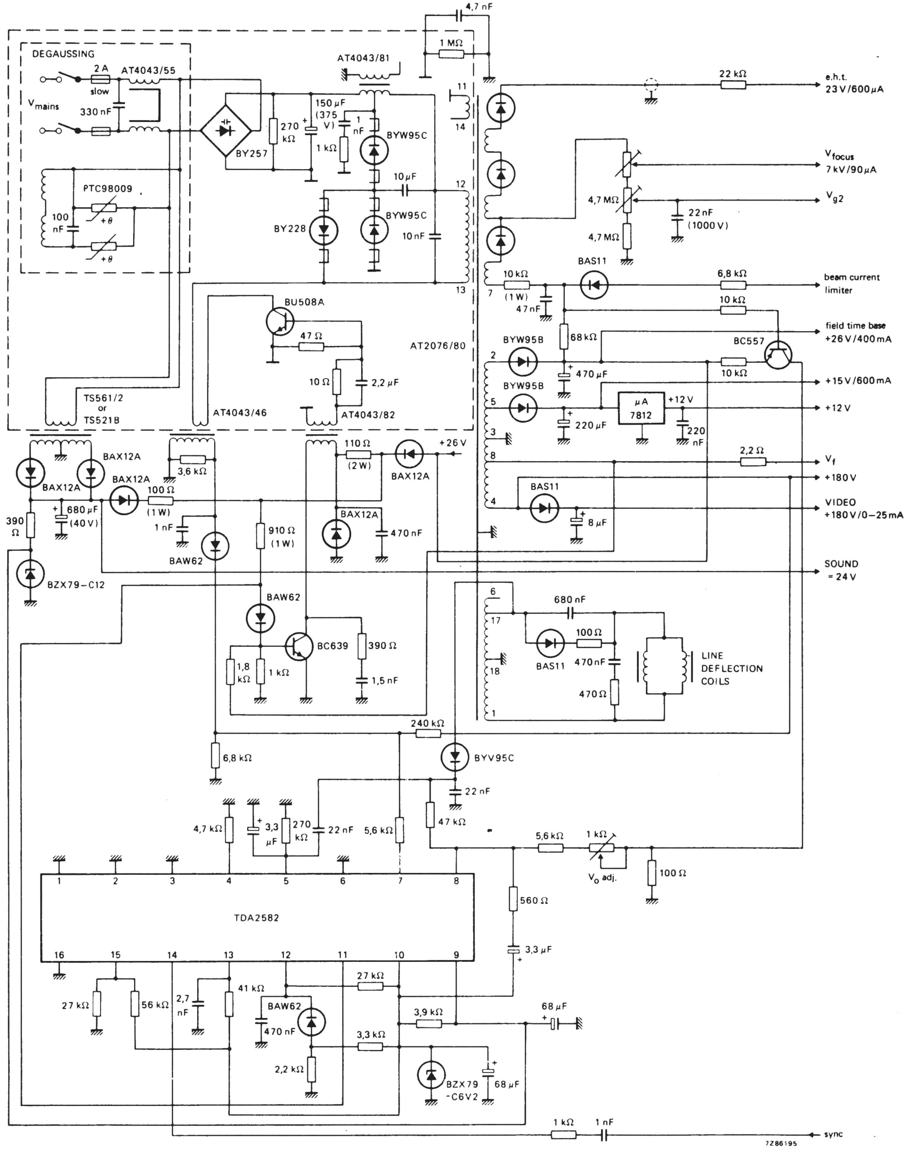

DEGAUSSING
2 A
slow
AT4043/55
V_mains
330 nF
PTC98009
+θ
100 nF
BY257
270 kΩ
150 µF (375 V)
1 nF
1 kΩ
AT4043/81
BYW95C
10 µF
BY228
BYW95C
10 nF
4,7 nF
1 MΩ
11
14
12
13
BU508A
47 Ω
10 Ω
2,2 µF
AT2076/80
TS561/2 or TS521B
AT4043/46
AT4043/82
BAX12A
3,6 kΩ
100 Ω (1 W)
680 µF (40 V)
390 Ω
BZX79-C12
1 nF
BAW62
910 Ω (1 W)
110 Ω (2 W)
+26 V
470 nF
BC639
390 Ω
1,5 nF
1,8 kΩ
1 kΩ
240 kΩ
6,8 kΩ
BYV95C
22 nF
4,7 kΩ
3,3 µF
270 kΩ
5,6 kΩ
47 kΩ
5,6 kΩ
1 kΩ
V_o adj.
100 Ω
560 Ω
TDA2582
27 kΩ
56 kΩ
2,7 nF
41 kΩ
470 nF
2,2 kΩ
3,9 kΩ
3,3 kΩ
68 µF
BZX79 -C6V2
1 kΩ
1 nF
sync
22 kΩ
e.h.t. 23 V/600 µA
V_focus 7 kV/90 µA
V_g2
4,7 MΩ
22 nF (1000 V)
BAS11
10 kΩ (1 W)
47 nF
6,8 kΩ
beam current limiter
10 kΩ
68 kΩ
field time base +26 V/400 mA
BYW95B
BC557
470 µF
+15 V/600 mA
µA 7812
+12 V
220 µF
220 nF
2,2 Ω
V_f
+180 V
8 µF
VIDEO +180 V/0–25 mA
SOUND ≈ 24 V
680 nF
100 Ω
LINE DEFLECTION COILS
470 Ω
7Z86195

Fig. 3 Application circuit.

AT2076/81
AT2076/81A
Replaces AT2076/51

MINIATURE DIODE-SPLIT LINE OUTPUT TRANSFORMER

- Three-layer e.h.t coil, focus tap for hi-bi
- Aluminium foil primary winding
- Reduced dimensions, reduced mass

QUICK REFERENCE DATA

For transistor line output stages

	110° deflection angle	90° deflection angle
I_{eht}	max. 1,5 mA	max. 1 mA
E.H.T.	25 kV	25 kV
$R_{i(eht)}$	1,6 MΩ	2,9 MΩ
I_{p-p} deflection (incl. 6% overscan)	5,3 A	2,85 A
Supply voltage (V_B')	150 V	148,1 V
Supply current ($I_{average}$)	466 mA	299 mA
Voltages of primary windings*	+ 98 V_p, + 530 V_p, + 960 V_p, + 1060 V_p	+ 100 V_p, + 514 V_p, + 930 V_p, + 1030 V_p, + 1190 V_p
Voltages of auxiliary windings	−290 V_p, −230 V_p, −148 V_p, + 62 V_p, + 105 V_p	−270 V_p, −222 V_p, −141 V_p, + 60 V_p, + 105 V_p

picture tube heater voltage

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 110° and 90° colour picture tubes in transistor or gate turn-off thyristor equipped television receivers presenting 625 lines at 50 fields per second (CCIR) or 525 lines at 60 fields per second (USA). The transformer may also be used in colour monitors at 24 kV and monochrome monitors at 17 kV e.h.t.

It is intended for use in conjunction with:

	110° deflection angle	90° deflection angle
– deflection unit	AT1271, AT1270/00, AT1260, AT1250	AT1235/00, AT1235/40
– bridge coil	AT4043/68	AT4043/68
– linearity control unit	AT4042/42, AT4042/30	AT4042/02, AT4042/04P
– line output transistor, or	BU508A	BU508A
– fast gate turn-off thyristor	BTW58	BTW58

– screened e.h.t. cable, length 1 m; catalogue number 3122 137 62300
– focus cable, length 31 cm; catalogue number 3122 131 00732.

Note: Types AT2076/81 and AT2076/81A differ only in manufacturing technique; apart from this the transformers are identical.

DESCRIPTION

The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The primary winding together with its e.h.t. winding are moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC65, para. 14.4 and UL492, para. 280-SE1. The transformer has 2 M3 screw-studs for mounting. External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

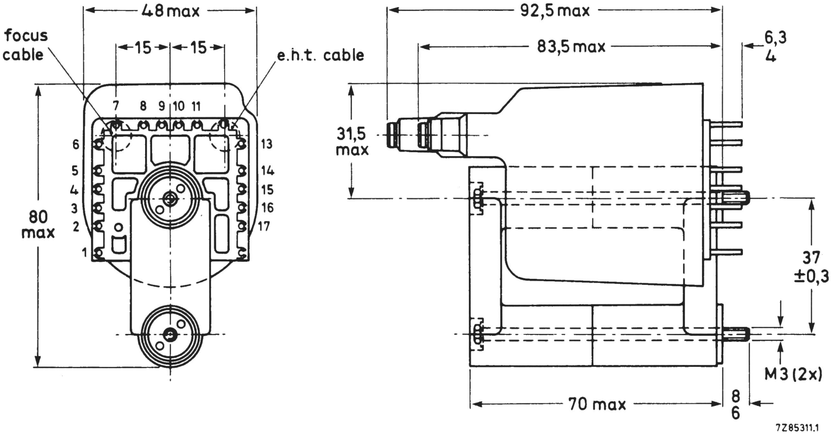
---

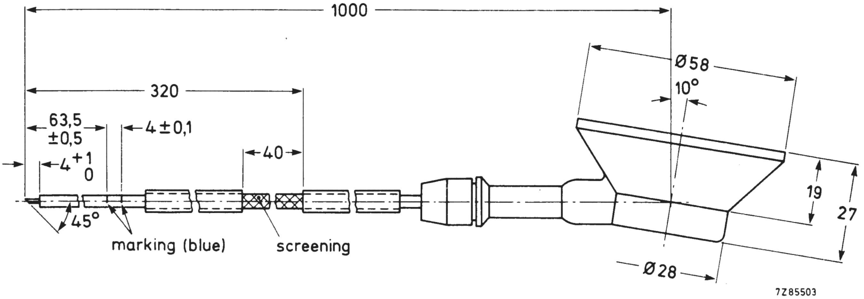
* D.C. component on these pulses is V_B' (see Fig. 3).

MECHANICAL DATA

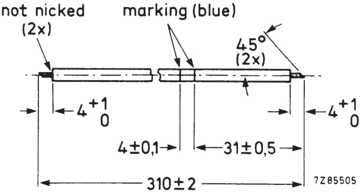
Dimensions in mm

Outlines


48 max
focus cable
15
15
e.h.t. cable
7
8
9
10
11
6
13
5
14
4
15
3
16
2
17
1
80 max
92,5 max
83,5 max
6,3
4
31,5 max
37 ±0,3
M3 (2x)
70 max
8
6
7Z85311.1


1000
Ø58
10°
320
63,5 ±0,5
4 ±0,1
40
4 +1 0
45°
marking (blue)
screening
19
27
Ø28
7Z85503

e.h.t. cable


not nicked (2x)
marking (blue)
45° (2x)
4 +1 0
4 +1 0
4±0,1
31±0,5
310±2
7Z85505

focus cable

Fig. 1.

Mass 325 g

Solderability in accordance with IEC 68, test T

Mounting

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. For mounting on a printed-wiring board a washer of 20 mm outer diameter has to be used; the tightening torque of the printed-wiring board is 500 + 100 mNm. The fit of the connecting pins and the studs in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

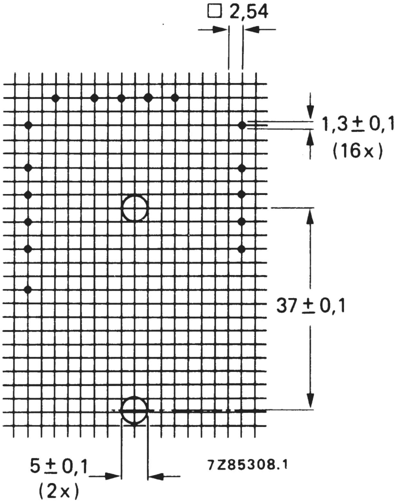


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Whether the transformer is board or chassis mounted, **the core must be earthed.**

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it is recommended to provide sufficient flow of cool air around the transformer.

Distances

The following minimum distances between the transformer and **neighbouring conductive flat surfaces** must be maintained:

From the e.h.t. coil radially, 10 mm
From the e.h.t. coil axially, 10 mm

Sharp edges of conductive parts must have greater distances than given above.

The transformer, leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops, etc.

ELECTRICAL DATA with 110° COLOUR PICTURE TUBES

E.H.T. supply	I_{eht}	mA	0,03	1	1,5
	e.h.t.	kV	25,0	23,4	22,6
	$R_{i(eht)}$	MΩ	1,6	1,6	1,6
Power supply	V_B	V	157,8	157,8	157,8
	V_B'	V	150,2	145,7	143,3
	$I_{average}$	mA	242	393	466
Output transistor	V_{CEM}	V	1240	1220	1200
	$+ I_{CEM}$	A	3,6	3,7	3,7
Deflection	I_{p-p}	A	5,3	5,1	5,0
	$t_{flyback}$	μs	11,4	–	–
	Overscan	%	6	–	–
V_{focus}		kV	8,1	7,9	7,8
Auxiliary windings: **picture tube heater voltage V_{3-1} (r.m.s.)**		V	8,3	8,0	7,8
peak voltages at					
pin 2	V_2	V	−290		
pin 6	V_6	V	−148		
pin 4	V_4	V	+62		
pin 5	V_5	V	−230		
pin 8	V_8	V	+105		
pin 9	V_9*	V	+98		
pin 14	V_{14}*	V	+530		
pin 17	V_{17}*	V	+960		
pin 16	V_{16}*	V	+1060		

Above measurements using circuits of Figs 3, 4a and 4b.

An alternative 3-diode modulator circuit is shown in Fig. 4c.

---

* D.C. component on these pulses is V_B'.

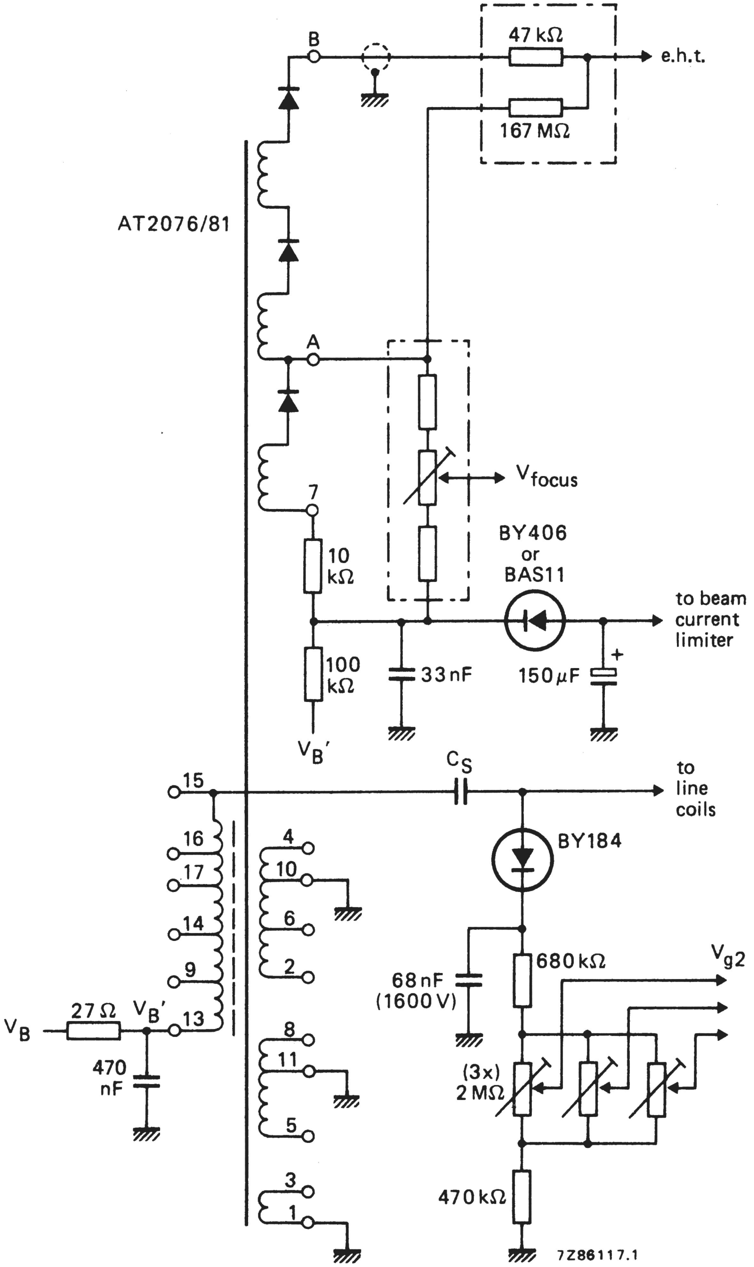

B
47 kΩ
e.h.t.
167 MΩ
AT2076/81
A
Vfocus
7
10 kΩ
BY406 or BAS11
to beam current limiter
100 kΩ
33 nF
150 µF
+
VB'
CS
15
to line coils
16
17
14
9
13
4
10
6
2
8
11
5
3
1
BY184
68 nF (1600 V)
680 kΩ
Vg2
VB
27 Ω
VB'
470 nF
(3x) 2 MΩ
470 kΩ
7Z86117.1

Fig. 3 Circuit diagram of transformer, and e.h.t., focus voltage and V_{g2} circuits.

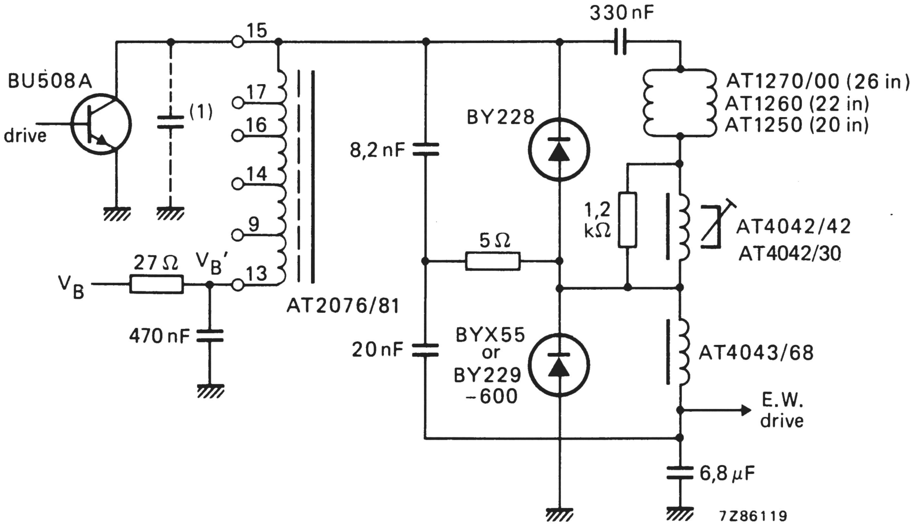

BU508A
drive
(1)
15
17
16
14
9
13
27 Ω
V_B'
V_B
470 nF
AT2076/81
8,2 nF
20 nF
5 Ω
BY228
BYX55
or
BY229
-600
330 nF
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2
kΩ
AT4042/42
AT4042/30
AT4043/68
E.W.
drive
6,8 μF
7Z86119

Fig. 4a Diode modulator with split tuning.

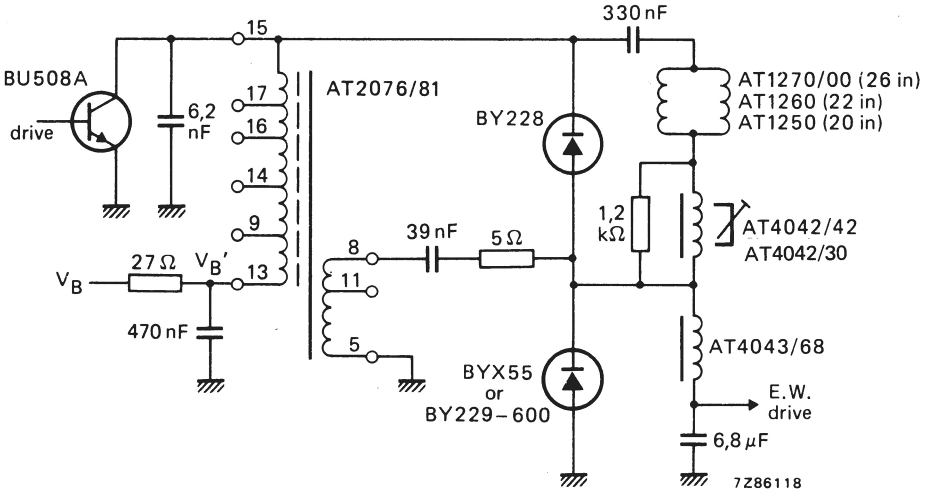

BU508A
drive
6,2
nF
15
17
16
14
9
13
27 Ω
V_B'
V_B
470 nF
AT2076/81
8
11
5
39 nF
5 Ω
BY228
BYX55
or
BY229-600
330 nF
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
1,2
kΩ
AT4042/42
AT4042/30
AT4043/68
E.W.
drive
6,8 μF
7Z86118

Fig. 4b Diode modulator with tap on transformer.

(1) Transformer stray capacitance.

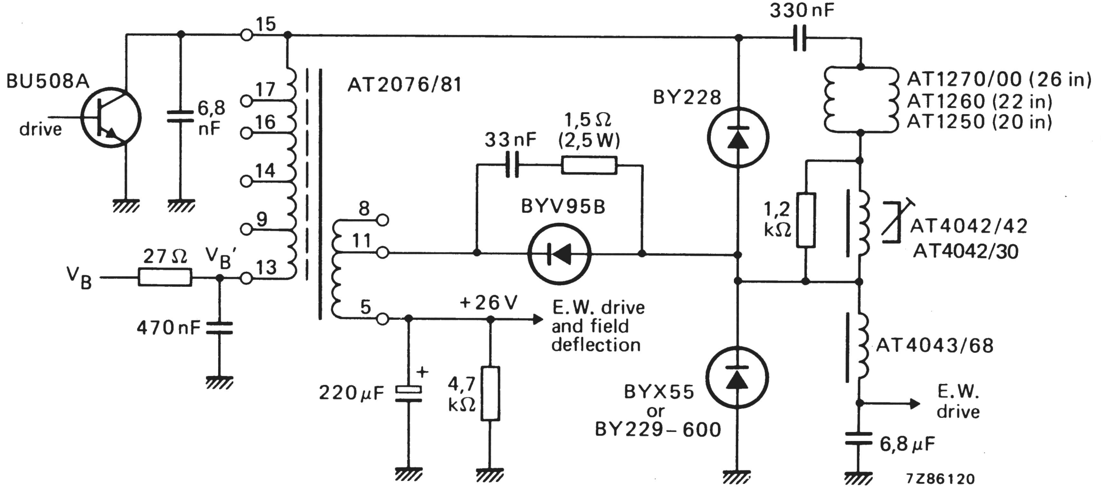

330 nF
15
BU508A
drive
6,8
nF
17
16
14
9
13
AT2076/81
V_B
27 Ω
V_B'
470 nF
8
11
5
33 nF
1,5 Ω
(2,5 W)
BYV95B
+26 V
E.W. drive
and field
deflection
220 μF
+
4,7
kΩ
BY228
BYX55
or
BY229 – 600
1,2
kΩ
AT1270/00 (26 in)
AT1260 (22 in)
AT1250 (20 in)
AT4042/42
AT4042/30
AT4043/68
E.W.
drive
6,8 μF
7Z86120

Fig. 4c Three-diode modulator circuit.

ELECTRICAL DATA with 90° COLOUR PICTURE TUBES

			Figs 3 and 5a V_B = 154,5 V		Figs 3 and 5b V_B = 134,3 V	
E.H.T. supply	I_{eht}	mA	0,03	1	0,03	1
	e.h.t.	kV	25,0	22,1	25,0	22,0
	$R_{i(eht)}$	MΩ	2,9		3	
Power supply	V_B'	V	151,5	148,1	130,0	126,1
	$I_{average}$	mA	173	299	245	389
Output transistor	V_{CEM}	V	1220	1150	1060	995
	$+I_{CEM}$	A	2,0	2,2	2,4	2,6
Deflection	$I_{p\text{-}p}$	A	2,90	2,78	2,92	2,89
	$t_{flyback}$	μs	11,45		11,45	
	Overscan	%	6	7,0	6	7,0
V_{focus}		kV	8,45	7,40	8,6	7,65
Auxiliary windings: picture tube heater voltage $V_{3\text{-}1}$ (r.m.s.)		V	8,11		8,15	
peak voltages at						
pin 2	V_2	V	−270		−274	
pin 6	V_6	V	−141		−144	
pin 4	V_4	V	+60		+61	
pin 11	V11	V	−222		−225	
pin 8	V_8	V	+105		+105	
pin 9	V_9*	V	+100		+102	
pin 14	V_{14}*	V	+514		+520	
pin 15	V_{15}*	V	+1190		+1200	
pin 16	V_{16}*	V	+930		+940	
pin 17	V_{17}*	V	+1030		+1040	

Above measurements using circuits of Figs 3, 5a and 5b.

---

* D.C. component on these pulses is V_B'.

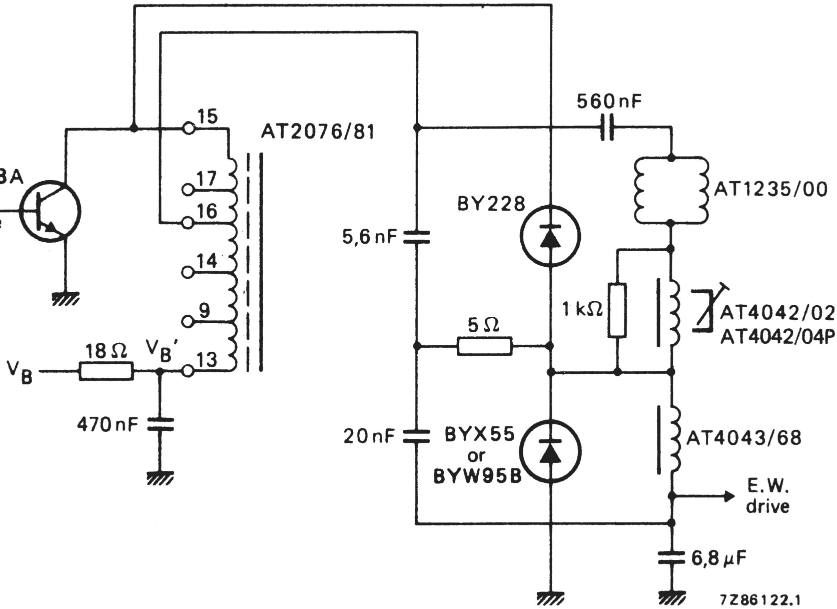

BU508A
drive
15
17
16
14
9
13
AT2076/81
18 Ω
V_B'
V_B
470 nF
5,6 nF
5 Ω
20 nF
BY228
BYX55
or
BYW95B
560 nF
AT1235/00
1 kΩ
AT4042/02
AT4042/04P
AT4043/68
E.W.
drive
6,8 µF
7Z86122.1

Fig. 5a Diode modulator, $V_B' = 150$ V.

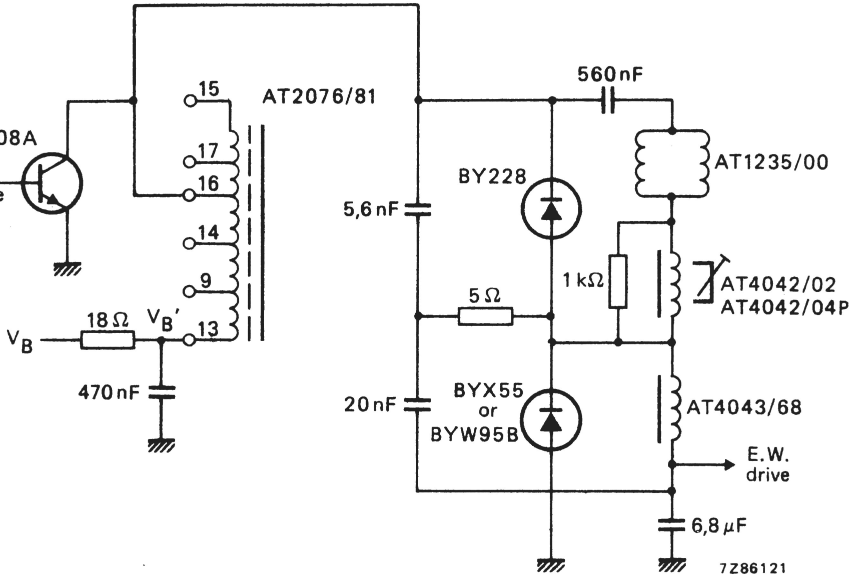

BU508A
drive
15
17
16
14
9
13
AT2076/81
18 Ω
V_B'
V_B
470 nF
5,6 nF
5 Ω
20 nF
BY228
BYX55
or
BYW95B
560 nF
AT1235/00
1 kΩ
AT4042/02
AT4042/04P
AT4043/68
E.W.
drive
6,8 µF
7Z86121

Fig. 5b Diode modulator, $V_B' = 130$ V.

3122 138 91930

SWITCHED-MODE TRANSFORMER

- without mains isolation

APPLICATION

The AT2097/01 has been designed for use as a switched-mode transformer for 90° colour television receivers without mains isolation, in conjunction with the switched-mode driver transformer AT4043/58.

MECHANICAL DATA

The magnetic circuit of the transformer comprises two Ferroxcube U25-cores. The item is provided with eight pins for mounting on a printed-wiring board.

Outlines

Dimensions in mm

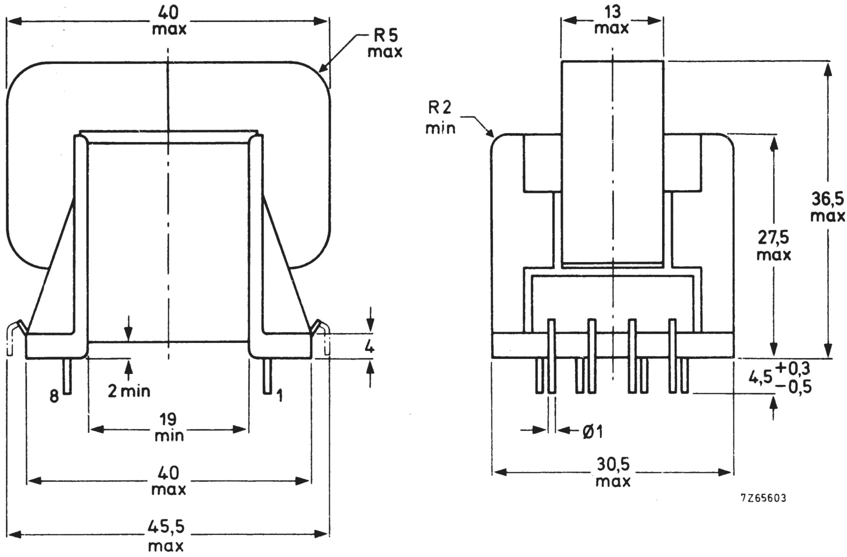

40
max
R5
max
8
2 min
1
4
19
min
40
max
45,5
max
13
max
R2
min
36,5
max
27,5
max
4,5 +0,3 −0,5
Ø1
30,5
max
7Z65603

Fig. 1.

Mounting

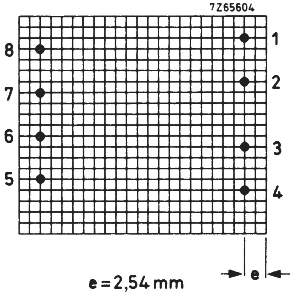


Fig. 2 Hole pattern (viewed from solder side) for mounting on a printed-wiring board, hole diameter 1,3 + 0,1 mm.

ELECTRICAL DATA

Inductance primary (8-6) *	16 mH ± 10%
Resistance primary (8-6) at 25 °C	3,2 Ω ± 12%
Resistance secondary at 25 °C	
(7-5)	0,14 Ω ± 12%
(4-3)	0,57 Ω ± 12%
Leakage inductance (7-5) **	⩽ 1,5 μH
Transformation ratio	
8-6/7-5	36,5
8-6/4-3	6,5
Maximum working temperature	115 °C

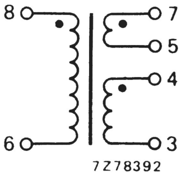


Fig. 3.

---

* Measuring conditions: E = 1,6 V; f = 1000 Hz.

** Measuring conditions: primary (8-6) short-circuited; E = 250 mV; 1,7 MHz ⩽ f ⩽ 2,2 MHz.

Application circuit

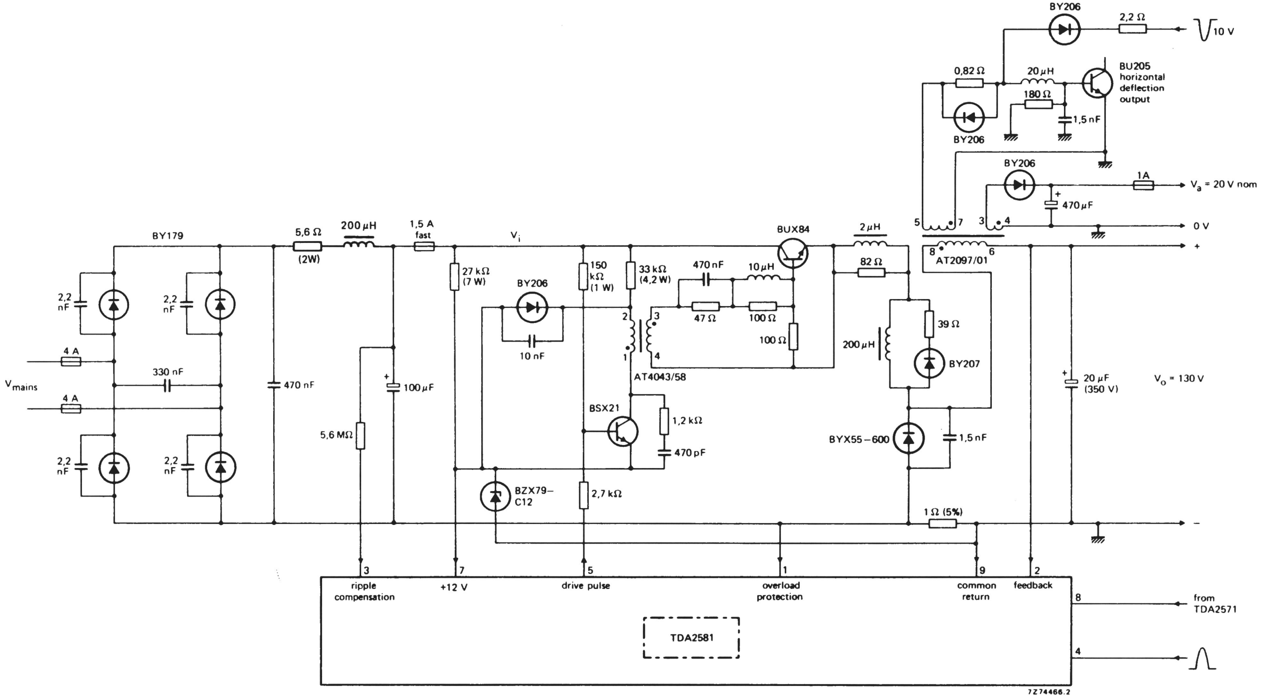

BY206
2,2 Ω
10 V
0,82 Ω
20 μH
180 Ω
BU205
horizontal
deflection
output
1,5 nF
BY206
BY206
1A
V_a = 20 V nom
470 μF
0 V
+
−
BY179
5,6 Ω
(2W)
200 μH
1,5 A
fast
V_i
BUX84
2 μH
82 Ω
AT2097/01
2,2 nF
4 A
330 nF
V_{mains}
470 nF
100 μF
5,6 MΩ
27 kΩ
(7 W)
BY206
10 nF
150 kΩ
(1 W)
33 kΩ
(4,2 W)
470 nF
10 μH
47 Ω
100 Ω
100 Ω
AT4043/58
BSX21
1,2 kΩ
470 pF
BZX79–C12
2,7 kΩ
200 μH
39 Ω
BY207
BYX55–600
1,5 nF
1 Ω (5%)
20 μF
(350 V)
V_o = 130 V
ripple
compensation
+12 V
drive pulse
overload
protection
common
return
feedback
from
TDA2571
TDA2581
7Z74466.2

Fig. 4 Circuit of an SMPS using a forward converter for providing the power supplies and the horizontal drive for a television receiver.

DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

DT2097/02

replaces AT2097/01

SWITCHED-MODE TRANSFORMER

- Without mains isolation

APPLICATION

The DT2097/02 is for use as a series switched-mode transformer for colour television receivers without mains isolation.

MECHANICAL DATA

This transformer comprises two Ferroxcube U25 cores and a standard U25 coil former with 10 pins for mounting on a printed-wiring board.

Dimensions of the transformer

length	max.	42,5 mm
width	max.	34,5 mm
height	max.	36 mm
length of connecting pins		4,5 ± 0,5 mm

Note: This transformer is not pin-compatible with the AT2097/01.

Mounting

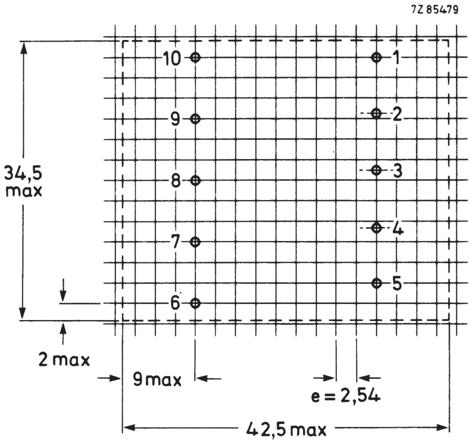
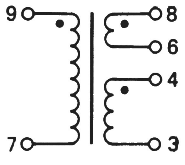

7Z 85479
10
9
8
7
6
1
2
3
4
5
34,5
max
2 max
9 max
e = 2,54
42,5 max

Fig. 1 Hole pattern (viewed from solder side) for mounting on a printed-wiring board, hole diameter 1,3 + 0,1 mm.

ELECTRICAL DATA

Inductance primary (9-7)*	16 mH ± 10%
Resistance primary (9-7) at 25 °C	3,2 Ω ± 12%
Resistance secondary at 25 °C	
(8-6)	0,14 Ω ± 12%
(4-3)	0,57 Ω ± 12%
Leakage inductance (8-6)**	⩽ 1,5 μH
Transformation ratio	
9-7/8-6	36,5
9-7/4-3	6,5
Maximum working temperature	115 °C



7Z85480

Fig. 2.

---

* Measuring conditions: E = 1,6 V; f = 1000 Hz.

** Measuring conditions: primary (9-7) short-circuited; E = 250 mV; 1,7 MHz ⩽ f ⩽ 2,2 MHz.

3122 108 28230 ←

ADJUSTABLE LINEARITY CONTROL UNIT

APPLICATION

This unit has been designed to adjust the linearity of the line deflection in monochrome television sets in conjunction with deflection unit AT1040/15, and in 90° colour television sets in conjunction with deflection unit AT1235/00.

DESCRIPTION

The control unit consists of a coil wound on a Ferroxcube rod, and three Ferroxdure magnets. One magnet is placed around the Ferroxcube rod, above the coil. One of the magnets has the shape of a half ring; it is placed around the Ferroxcube rod under the coil. The third Ferroxdure magnet is cylindrical, it is positioned parallel to and clamped against the Ferroxcube rod opposite the second. It is provided with a square hole to facilitate turning to adjust the biasing field and so the linearity of the line deflection.

MECHANICAL DATA

Dimensions in mm

Outlines

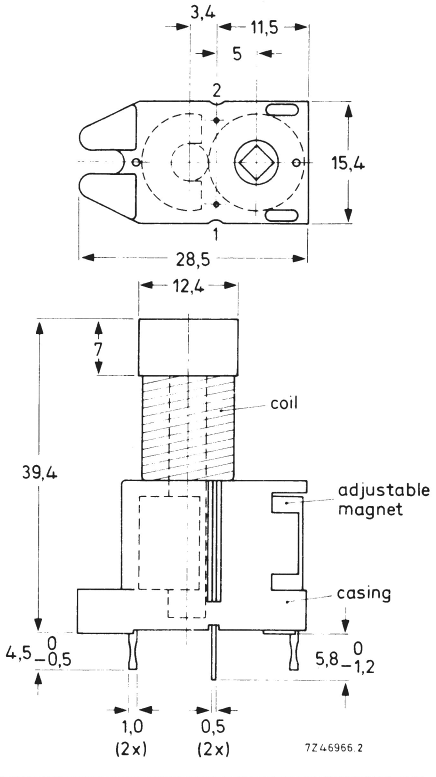
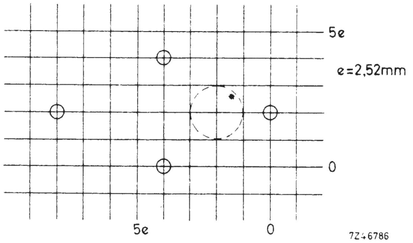


Fig. 1.

Mounting

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 2), or on metal chassis, by bending of the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 3). To prevent distortion of the magnetic field no iron part should approach the magnetic parts anywhere nearer than 3 mm. The coil should be shunted with a carbon resistor to damp ringing phenomena (value of resistor depends on line-deflection transformer used).



* Hole only necessary for bottom adjustment.

Fig. 2 Hole pattern for mounting on a printed-wiring board (e = 2,54 mm (0,1 in).

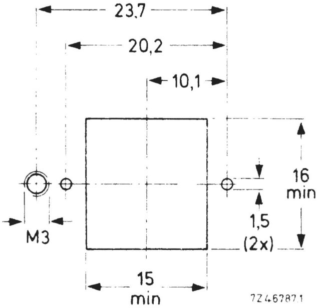


Fig. 3 Hole pattern for mounting on a chassis.

ELECTRICAL DATA

When a sawtooth current (without S-correction) of 2,8 A p-p, frequency 15 625 Hz, flyback ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 15 V and 26 V.

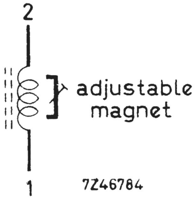


Fig. 4 Circuit diagram.

APPLICATION CIRCUITS

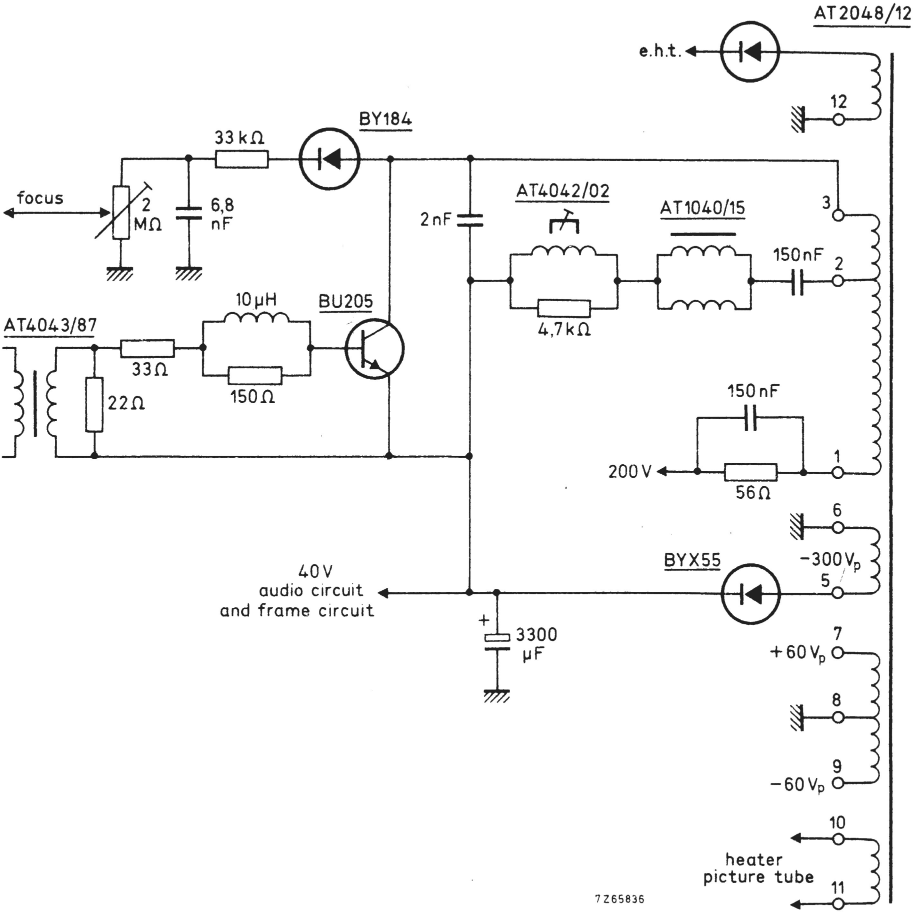

AT2048/12
e.h.t.
12
BY184
33 kΩ
focus
2 MΩ
6,8 nF
2 nF
AT4042/02
AT1040/15
3
150 nF
2
4,7 kΩ
10 µH
BU205
AT4043/87
33 Ω
150 Ω
22 Ω
150 nF
200 V
56 Ω
1
6
BYX55
−300 V_p
5
40 V
audio circuit
and frame circuit
+
3300 µF
7
+60 V_p
8
9
−60 V_p
10
heater
picture tube
11
7Z65836

Fig. 5 Line deflection circuit for a monochrome television set.

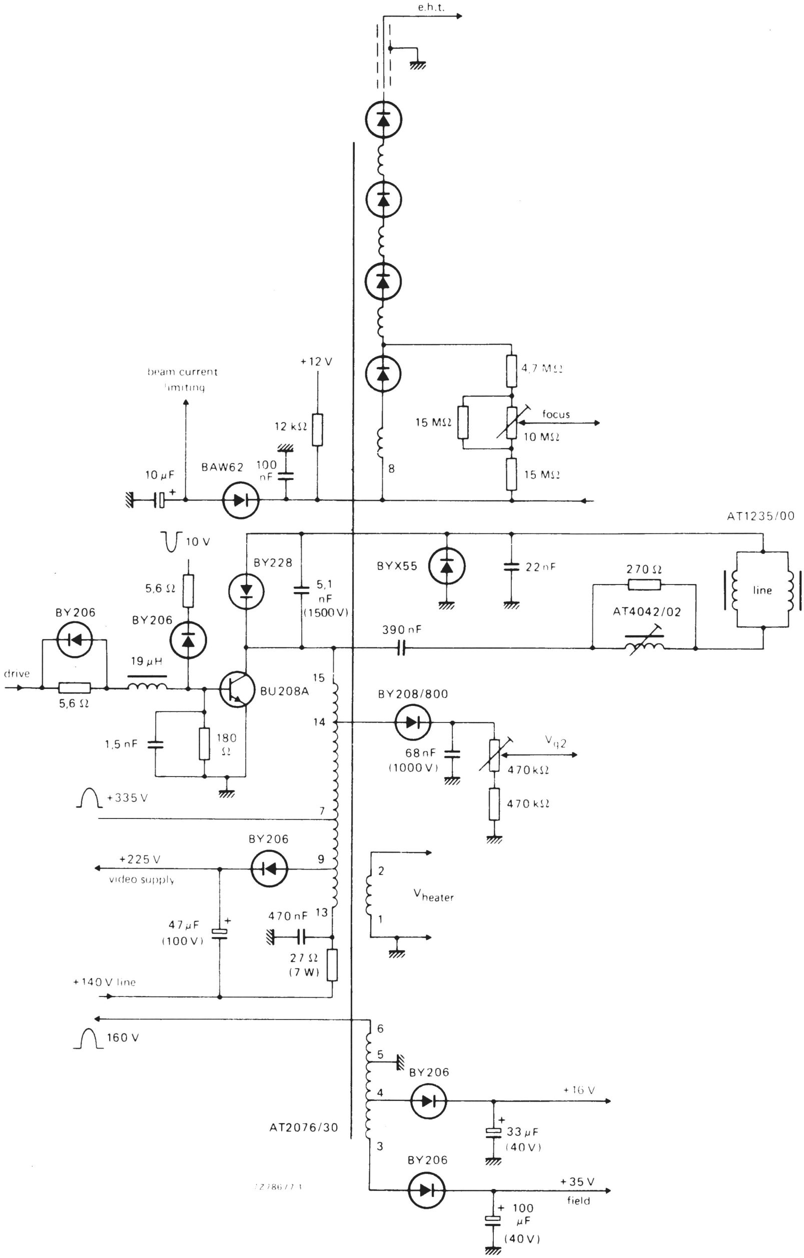

e.h.t.
beam current limiting
+12 V
12 kΩ
100 nF
10 µF
BAW62
4,7 MΩ
15 MΩ
focus
10 MΩ
15 MΩ
8
AT1235/00
10 V
BY228
5,1 nF (1500 V)
BYX55
22 nF
270 Ω
line
AT4042/02
390 nF
5,6 Ω
BY206
BY206
19 µH
drive
5,6 Ω
BU208A
15
14
BY208/800
68 nF (1000 V)
V_{g2}
470 kΩ
470 kΩ
1,5 nF
180 Ω
+335 V
7
BY206
+225 V
video supply
9
2
V_{heater}
1
47 µF (100 V)
470 nF
13
27 Ω (7 W)
+140 V line
160 V
6
5
BY206
4
+16 V
33 µF (40 V)
AT2076/30
3
BY206
+35 V
field
100 µF (40 V)
7Z78677.1

Fig. 6 Line deflection circuit for a 90° colour television set.

LINEARITY CORRECTOR

APPLICATION

This linearity corrector is for the line deflection output stage of the 30AX system. It is compatible with linearity control unit AT4042/42 (connections 1 and 2 of the AT4042/42 on the printed-wiring board to be connected to 3 and 4 respectively).

DESCRIPTION

The linearity corrector consists of a coil, mounted on a Ferroxcube rod and two ring-shaped magnets of plastic-bonded Ferroxdure. The magnets are placed around the rod, one at the top and one at the bottom.
The corrector has pins for mounting on a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

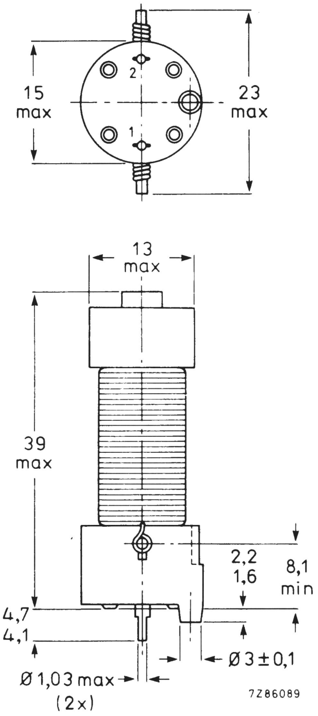


Fig. 1.

Mounting

The AT4042/30 can be mounted on printed-wiring boards by means of its two connection pins, see Fig. 2. To prevent distortion of the magnetic field, no magnetic-conductive materials should approach the magnetic parts nearer than 3 mm. The coil should be shunted with a carbon resistor to damp ringing phenomena; the value of the resistor depends on the line output transformer used (typical value 820 Ω).

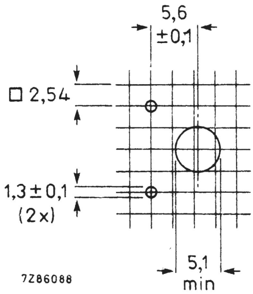


Fig. 2 Hole pattern for mounting on a printed-wiring board.

ELECTRICAL DATA

When a sawtooth current (without S-correction) of 5,1 A (p-p), frequency 15 625 Hz, flyback ratio 18%, flows through the linearity corrector, the correction voltage is 17,5 V ± 5,5%.

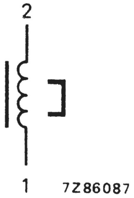


Fig. 3 Circuit diagram.

ADJUSTABLE LINEARITY CONTROL UNIT

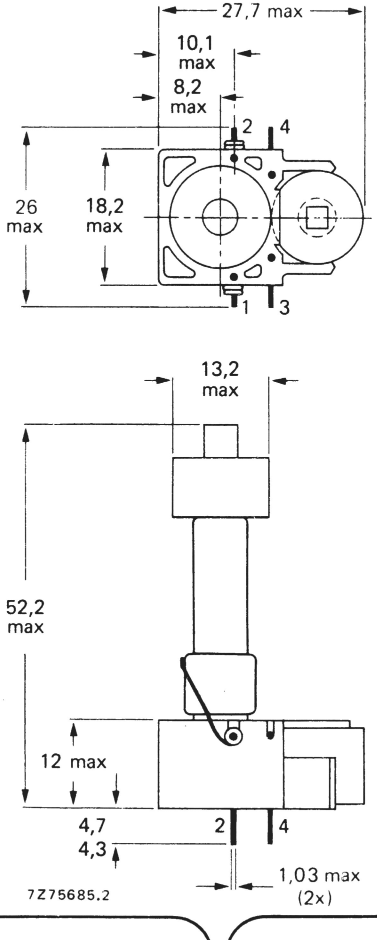
APPLICATION

This linearity control unit is for the line deflection output stage of the 30AX system and for data graphic display applications.

DESCRIPTION

The unit consists of a coil, mounted on a Ferroxcube rod, and three Ferroxdure magnets. Two ring-shaped magnets are placed around the Ferroxcube rod, one at the top and one at the bottom. The third magnet is positioned against the Ferroxcube rod opposite the bottom magnet and clamped. It is provided with a square hole to facilitate adjustment of the biasing field and, therefore, the linearity of the line deflection.

MECHANICAL DATA; Dimensions in mm



27,7 max
10,1 max
8,2 max
2
4
26 max
18,2 max
1
3
13,2 max
52,2 max
12 max
4,7
4,3
2
4
1,03 max (2x)

Fig. 1.

7Z75685.2

Mounting

The AT4042/42 can be mounted on printed-wiring boards by means of its two connection pins and two extra pins (without electrical function) which are provided for mounting only (see Fig. 2). To prevent distortion of the magnetic field, no iron part should approach the magnetic parts nearer than 3 mm. The coil should be shunted with a carbon resistor to damp ringing phenomena; the value of the resistor depends on the line output transformer used (typical value 820 Ω).

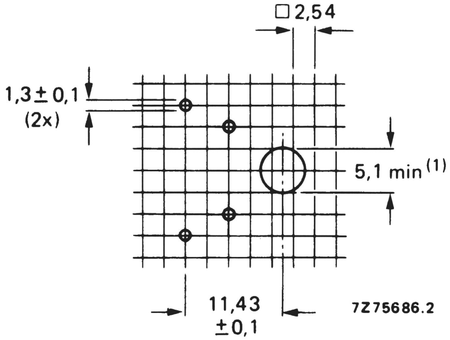


Fig. 2 Hole pattern for mounting on a printed-wiring board.
(1) Hole for bottom adjustment, if required.

ELECTRICAL DATA

When a sawtooth current (without S-correction) of 5 A (p-p), frequency 15 625 Hz, flyback ratio 18%, flows through the linearity control unit, the correction voltage is adjustable between 9 V and 18 V.

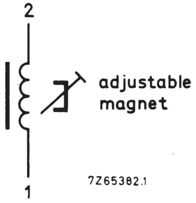


Fig. 3 Circuit diagram.

BRIDGE COIL

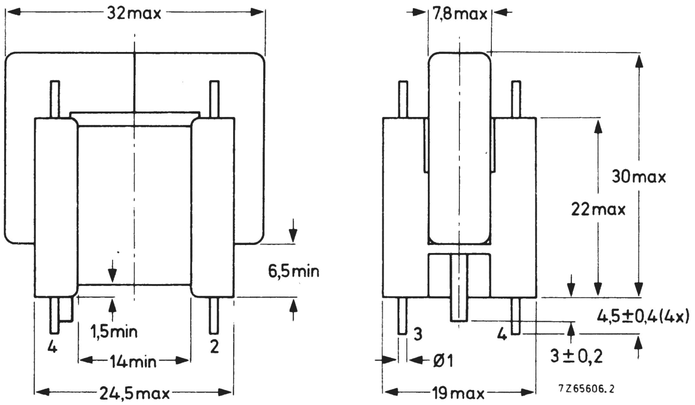
APPLICATION

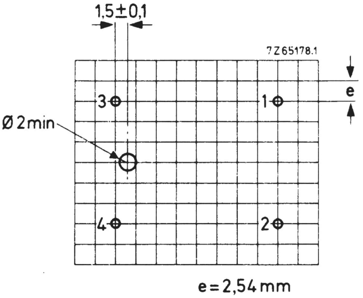
This correction coil has been developed to be used as a bridge transformer in the line output transformer circuitry of the AT2076/30 in conjunction with the deflection unit AT1080 (see also data sheet of the AT2076/30).

MECHANICAL DATA

The magnetic circuit of the coil comprises two Ferroxcube U-cores. The unit is provided with pins for mounting on a printed-wiring board.

Dimensions (mm)

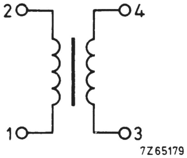

32max
6,5min
1,5min
4
2
14min
24,5max
7,8max
30max
22max
4,5±0,4(4x)
3
4
3±0,2
Ø1
19max
7Z65606.2


1,5±0,1
7Z65178.1
e
3
1
Ø2min
4
2
e=2,54mm

Hole pattern for mounting on a printed-wiring board. Hole diameter 1, 3 + 0, 1 mm. e = 2, 54 mm (0, 1 in).

ELECTRICAL DATA

Inductance (primary, 1-2)	425 μH ± 10%
Resistance (primary, 1-2)	< 0, 24 Ω
Maximum voltage, peak-to-peak	400 V
Maximum current, peak-to-peak	6, 7 A
Maximum current, r. m. s.	1, 8 A
Maximum working temperature	100 °C


2
4
1
3
7Z65179

3122 138 90290

SWITCHED-MODE DRIVER TRANSFORMER

with mains isolation

APPLICATION

The transformer AT4043/45 has been designed for use as a driver transformer in the synchronous power pack system for colour tv receivers with mains isolation. It is used in conjunction with current sensing transformer AT4043/46 and mains transformer TS561/2.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U20-cores. Two separate coil formers guarantee the required isolation between primary and secondary. The transformer is provided with 6 pins for mounting on a printed-wiring board.

Outlines

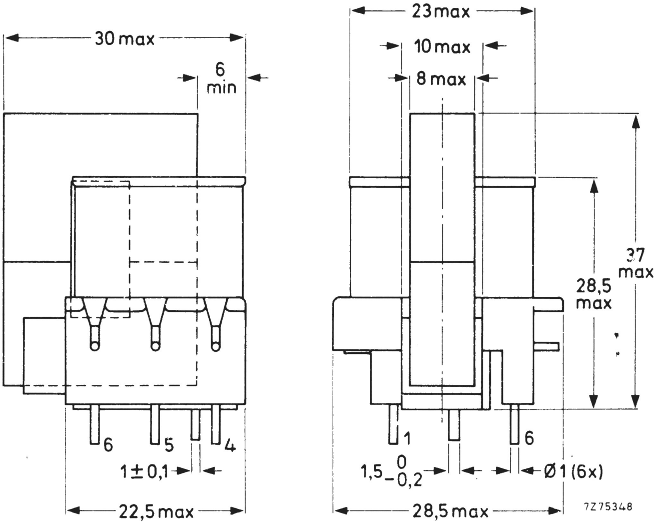

30 max
6 min
6
5
4
1 ± 0,1
22,5 max
23 max
10 max
8 max
37 max
28,5 max
1
6
1,5 0 −0,2
Ø1 (6x)
28,5 max
7Z75348

Fig. 1.

Mounting

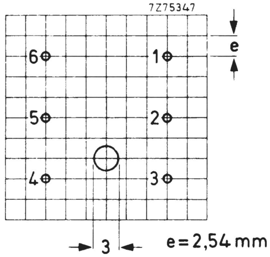


Fig.2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

ELECTRICAL DATA

Inductance, primary	(4 – 6)	⩾ 16 mH *
Resistance at 25 °C	(4 – 6)	2 Ω ± 12%
Leakage inductance, secondary	(1 – 3)	⩽ 6 μH **
Resistance at 25 °C	(1 – 3)	0,05 Ω ± 12%
Turns ratio		5 : 1
Mains isolation		acc. to IEC 65
Maximum working temperature		115 °C

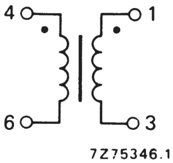


Fig. 3.

---

* Measuring condition: E = 8 V, f = 1 kHz.

** Measuring condition (primary short-circuited): E ⩽ 250 mV, 0,9 MHz ⩽ f ⩽ 1,1 MHz.

CURRENT SENSING TRANSFORMER
with mains isolation

APPLICATION

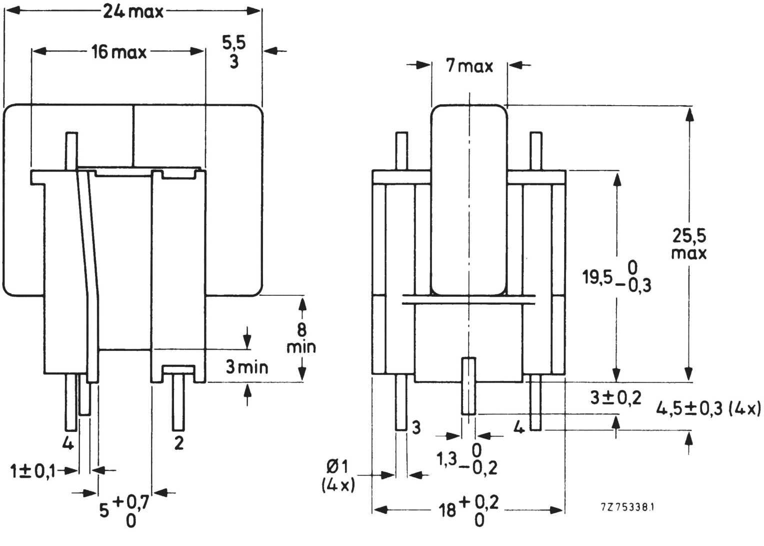
The transformer AT4043/46 has been designed for use as a sensing transformer in switched-mode power supply circuits.

MECHANICAL DATA

The magnetic circuit of the transformer comprises two Ferroxcube U15-cores. The primary turn is potted in the coil former to guarantee the required isolation. The transformer is provided with 4 pins for mounting on a printed-wiring board.

Outlines

Dimensions in mm



24 max
16 max
5,5
3
8
min
3 min
4
2
1±0,1
$5^{+0,7}_{0}$
7 max
25,5
max
$19{,}5^{0}_{-0,3}$
3±0,2
4,5±0,3 (4x)
3
4
Ø1
(4x)
$1{,}3^{0}_{-0,2}$
$18^{+0,2}_{0}$
7Z75338.1

Fig. 1

Mounting

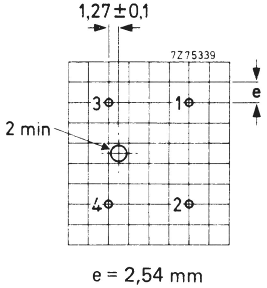

1,27 ± 0,1
7Z75339
e
3
1
2 min
4
2
e = 2,54 mm

Fig.2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

ELECTRICAL DATA

Inductance, secondary	(3 – 4)	⩾ 700 mH *
Resistance, secondary, at 25 °C	(3 – 4)	65 Ω ± 12%
Turns ratio		1 : 800
Mains isolation		acc. to IEC 65
Maximum working temperature		115 °C

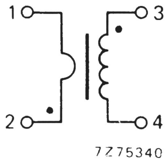

1
3
2
4
7Z75340

Fig.3

APPLICATION CIRCUIT

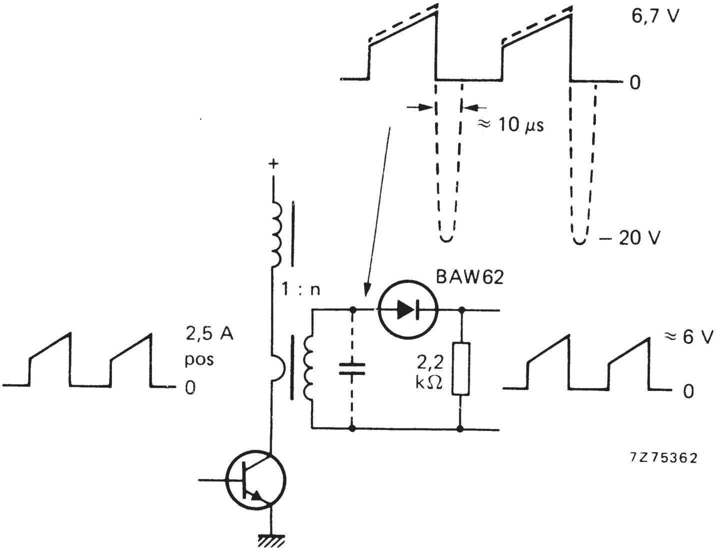

6,7 V
0
≈ 10 μs
– 20 V
+
BAW62
1 : n
2,5 A
pos
0
2,2
kΩ
≈ 6 V
0
7Z75362

Fig.4

---

* Measuring condition: E = 10 V, f = 1 kHz.

3122 138 93390

CURRENT SENSING TRANSFORMER

with mains isolation

APPLICATION

The AT4043/47 is a current sensing transformer in professional switched-mode power supply circuits. It can also be used as a measuring device in many applications.

MECHANICAL DATA

Dimensions in mm

The ungapped magnetic circuit of the transformer comprises two Ferroxcube U15-cores in grade 3C8. The primary turn is potted in the coil former to guarantee the required isolation. The transformer is provided with 4 pins for mounting on a printed-wiring board.

Outlines

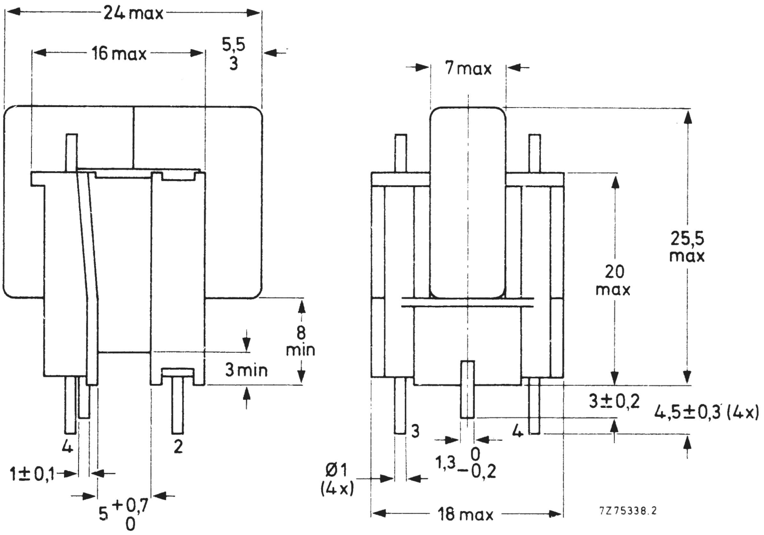

24 max
16 max
5,5
3
8
min
3 min
4
2
1±0,1
5 +0,7 0
7 max
25,5
max
20
max
3±0,2
4,5±0,3 (4x)
3
4
1,3 0 −0,2
Ø1
(4x)
18 max
7Z75338.2

Fig. 1.

Mounting

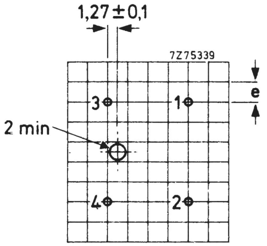

1,27±0,1
7Z75339
e
3
1
2 min
4
2

Fig. 2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

e = 2,54 mm

ELECTRICAL DATA

Inductance, secondary	(4 – 3)	⩾ 125 mH*
Resistance, secondary, at 25 °C	(4 – 3)	1 Ω ± 12%
Number of turns		1 prim., 100 sec.
Mains isolation at 5600 V d.c.		acc. to IEC 435
Maximum working temperature		115 °C
Inflammability		acc. to UL94V–1

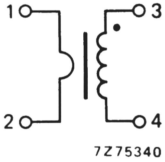
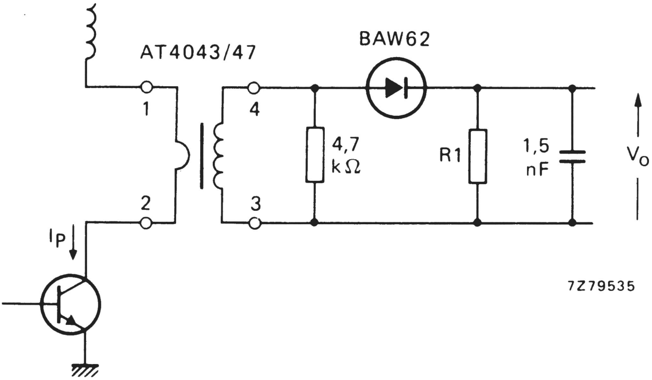

1
3
2
4
7Z75340

Fig. 3.

APPLICATION CIRCUIT


AT4043/47
BAW62
1
4
2
3
4,7 kΩ
R1
1,5 nF
V_o
I_P
7Z79535

typical values

I_P A	V_o V	R2 Ω	t_p µs	droop %
10	1	10	20	3
5	1	22	20	5
2,5	1	39	20	10
2,5	1	39	10	5

Fig. 4.

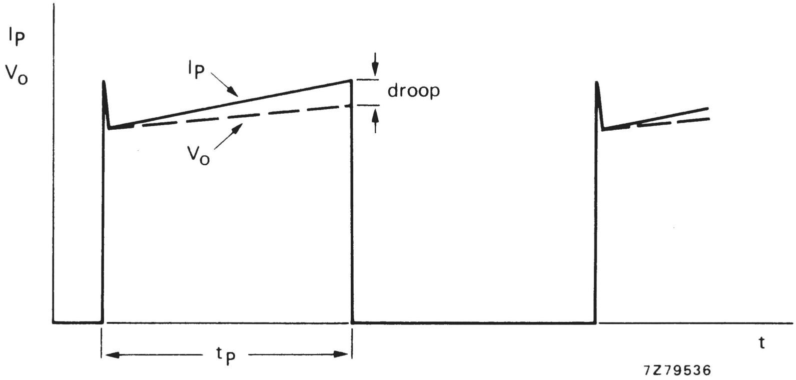


Fig. 5.

---

* Measuring condition: E = 1,3 V; f = 1 kHz.

The transformer withstands the following tests:

test	IEC68 test method	procedure
bump	Eb	1000 bumps, acceleration 40g, 6 directions
vibration	Fc	freq. 10-55-10 Hz, ampl. 0,75 mm, 6 directions, 30 min/direction
damp heat, steady state	Ca	21 days 40 °C; 93% R.H.
damp heat, cyclic	Db	21 days 40 °C
change of temperature	Na	−25 °C, +125 °C; 5 cycles
dry heat	Bb	16 h + 125 °C
solderability	T	230 ± 10 °C, 2 ± 0,5 s

3122 138 90580
3122 138 93400

THYRISTOR TRIGGER AND TRANSISTOR DRIVER TRANSFORMERS

- Mains isolation

APPLICATION

These transformers have been designed for use as thyristor and triac trigger transformers in professional applications where highly reliable primary to secondary voltage isolation is required, and as transistor driver transformers typically for use in switched-mode power supplies.

MECHANICAL DATA

Dimensions in mm

The magnetic circuits of the transformers comprise two Ferroxcube U20 cores in grade 3C8. Type AT4043/48 is ungapped, type AT4043/63 has two 60 μm gap spacers. The primary and secondary windings are wound on a two-part coil former with large creepage and clearance distances which ensure very safe isolation between mains and control circuits. The transformers are provided with pins for mounting on a printed-wiring board.

Outlines

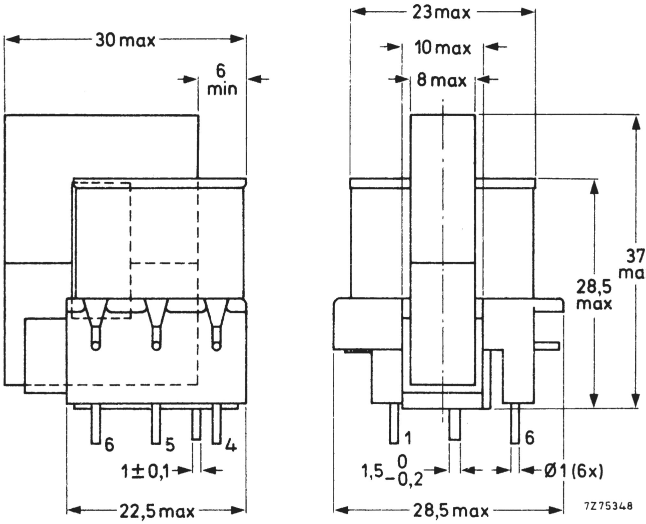


Fig. 1.

Mounting

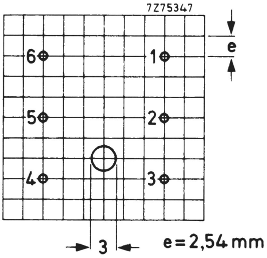


Fig. 2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

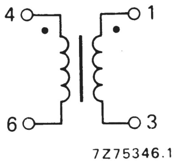


Fig. 3.

ELECTRICAL DATA (see Fig. 3)

		AT4043/48	AT4043/63
Inductance primary *	(4 – 6)	⩾ 6 mH	⩾ 1,9 mH
Resistance at 25 °C	(4 – 6)	1 Ω ± 12%	1 Ω ± 12%
Inductance, secondary	(1 – 3)	0,66 mH	0,22 mH
Resistance at 25 °C	(1 – 3)	0,1 Ω ± 12%	0,1 Ω ± 12%
Leakage inductance primary, secondary short-circuited **		⩽ 60 μH	
Leakage inductance secondary, primary short-circuited **		⩽ 6 μH	
Turns ratio 4-6/3-1		3/1	
Maximum Et product		1 mWb	
Maximum primary current (r.m.s.) for non-simultaneous switching		1 A	
Test voltage (d.c.) of winding 1-3 to winding 4-6 and core for 1 min		5600 V	
Test voltage (d.c.) of winding 4-6 to core for 1 mm		500 V	
Ambient temperature range			
operating		−25 to +80 °C	
storage		−40 to +100 °C	
Inflammability		acc. to UL94 V-1	

---

* Measuring condition: E = 1,5 V, f = 1 kHz.

** Measuring condition: E ⩽ 250 mV; 0,8 MHz ⩽ f ⩽ 1 MHz.

Environmental tests

The transformers withstand the following tests:

test	IEC68 test method	procedure
bump	Eb	1000 bumps, acceleration 40g, 6 directions
vibration	Fc	freq. 10-55-10 Hz, ampl. 0,75 mm 3 directions, 30 min/direction
damp heat, steady state	Ca	21 days, 40 °C, 93% R.H.
damp heat, cyclic	Db	21 days, 40 °C
change of temperature	Na	–25 °C, +125 °C, 5 cycles
dry heat	Bb	16 h, +125 °C
solderability	T	230 ± 10 °C, 2 ± 0,5 s

APPLICATION CIRCUITS

Type AT4043/48 used as a thyristor trigger transformer. This transformer is suitable for triggering all our thyristors and triacs.

Typical operating conditions:

Rise time	⩽ 0,5 μs
Pulse duration	15 μs
Duty factor	0,25
Trigger peak current	750 mA

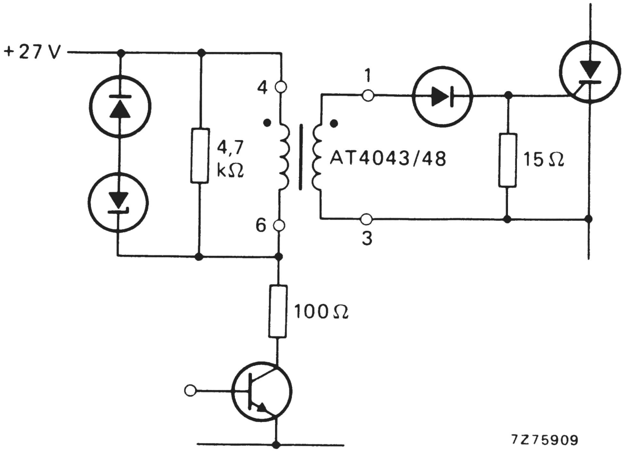


Fig. 4 Typical circuit.

Type AT4043/48 or type AT4043/63 as a transistor driver transformer.

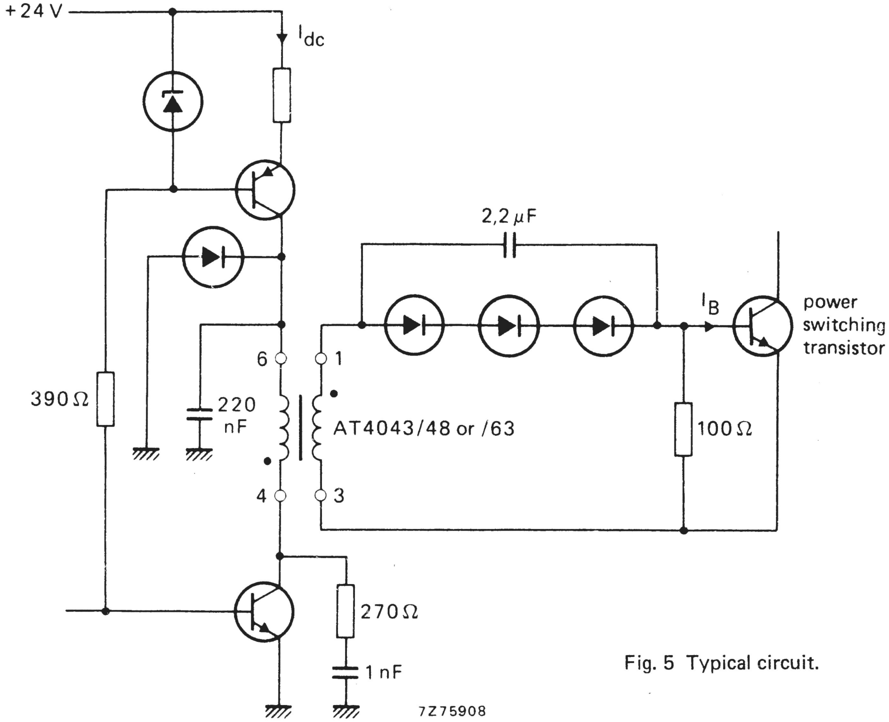

+24 V
I_{dc}
2,2 μF
I_B
power switching transistor
6
1
4
3
390 Ω
220 nF
AT4043/48 or /63
100 Ω
270 Ω
1 nF
7Z75908

Fig. 5 Typical circuit.

Typical operating conditions:

AT4043/48			
frequency kHz	I_{dc} mA	I_{B1} A	I_{B2} A
20	160	0,9	0,4
50	230	1,0	0,7

AT4043/63			
frequency kHz	I_{dc} mA	I_{B1} A	I_{B2} A
20	310	1,5	1,0
50	290	1,2	1,0

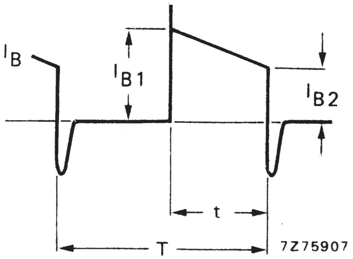

I_B
I_{B1}
I_{B2}
t
T
7Z75907

Fig. 6 $\frac{t}{T} = 0,4$.

3122 138 93410

POWER PACK SYSTEM SUPPLY CHOKE

for colour television

APPLICATION

The AT4043/52 has been designed to be used as a choke in a power pack system in conjunction with mains transformer TS561/2, mains filter choke AT4043/55, current sensing transformer AT4043/46, line choke AT4043/53 and power pack transformer AT2076/70.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the choke comprises two Ferroxcube U-cores. The coil is provided with pins for mounting on a printed-wiring board.

Outlines

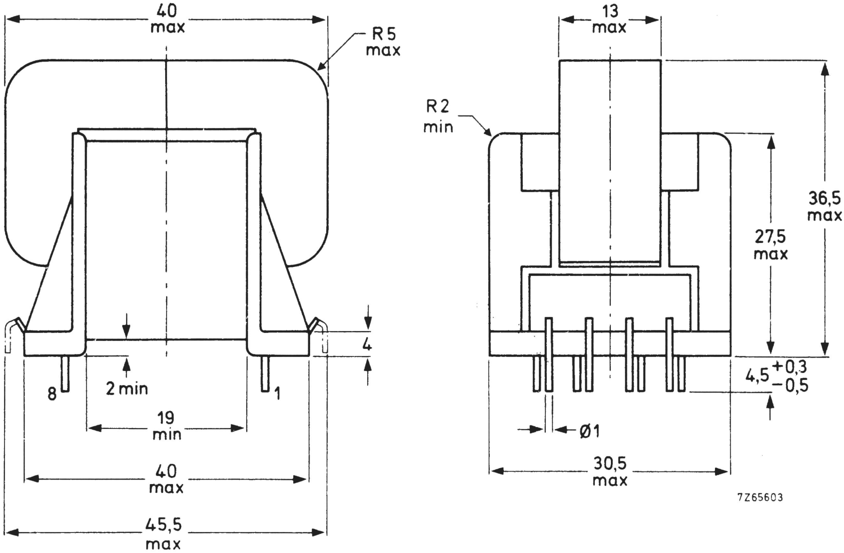

40
max
R5
max
4
8
2 min
1
19
min
40
max
45,5
max
13
max
R2
min
36,5
max
27,5
max
4,5 +0,3 −0,5
Ø1
30,5
max
7Z65603

Fig. 1.

Mounting

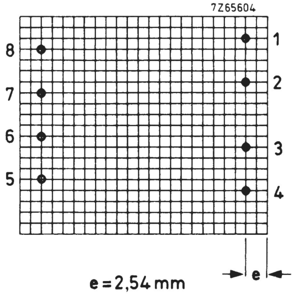

7Z65604
1
2
3
4
8
7
6
5
e = 2,54 mm
e

Fig. 2 Hole pattern (viewed from printed-wiring side) for mounting on a printed-wiring board, hole diameter 1,3 + 0,1 mm.

ELECTRICAL DATA

Inductance (2 – 5)*	9 mH ± 10%
Resistance (2 – 5)	2,2 Ω ± 10%
Maximum peak current	1,4 A
Maximum working temperature	115 °C
Inflammability	UL94V–1

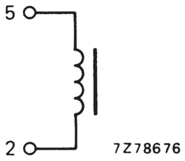


Fig. 3.

---

* Measuring condition: E = 1,5 V, f = 1 kHz.

3122 138 93420

POWER PACK SYSTEM LINE CHOKE

for colour television

APPLICATION

The AT4043/53 has been designed for use as a line choke in a power pack system in conjunction with mains transformer TS561/2, power pack transformer AT2076/70, etc. (see data on relevant transformer).

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the line choke comprises two Ferroxcube U-cores. The unit is provided with pins for mounting on a printed-wiring board.

Outlines

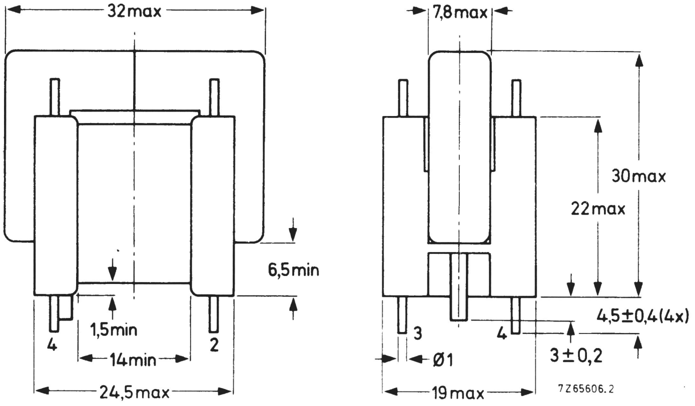

32max
6,5min
1,5min
4
2
14min
24,5max
7,8max
30max
22max
4,5±0,4(4x)
3
4
Ø1
3±0,2
19max
7Z65606.2

Fig. 1.

Mounting

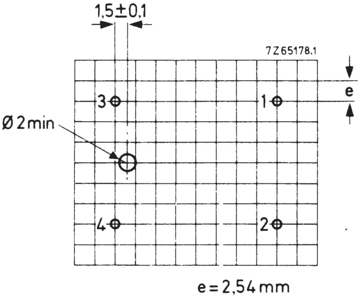


Fig. 2 Hole pattern for mounting on a printed-wiring board, viewed from component side. Hole diameter 1,3 + 0,1 mm.

ELECTRICAL DATA

Inductance (1-2)*	12 mH ± 10%
Resistance (1-2)	9,2 Ω ± 10%
Maximum peak current (1-2)	525 mA
Turns ratio 1-3/1-2	0,32
Maximum working temperature	115 °C
Inflammability	UL94V-1
Corona test voltage at 70 kHz	1700 V peak

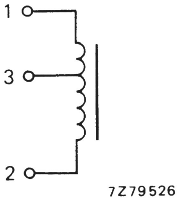


Fig. 3.

With the choke connected in the line timebase circuit with deflection unit AT1270, AT1260 or AT1250:

Deflection current p-p	5,35 A
Flyback time	11,5 μs
BU208A	
V_{CEM}	1150 V
I_C	3,1 A

With deflection unit AT1035/00:

Deflection current p-p	2,85 A
Flyback time	11,6 μs
BU205 or BU208A	
V_{CEM}	1000 V
I_C	1,7 A

---

* Measuring condition: E = 1 V, f = 1 kHz.

APPLICATION CIRCUITS

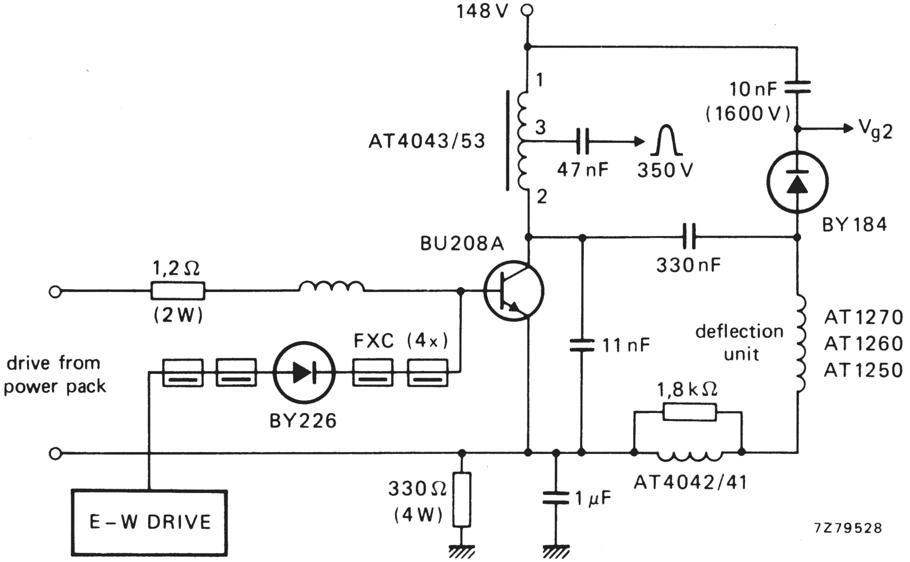

148 V
1
3
2
AT4043/53
47 nF
350 V
10 nF
(1600 V)
Vg2
BY184
BU208A
330 nF
1,2 Ω
(2 W)
drive from
power pack
FXC (4x)
BY226
11 nF
deflection
unit
AT1270
AT1260
AT1250
1,8 kΩ
AT4042/41
330 Ω
(4 W)
1 μF
E – W DRIVE
7Z79528

Fig. 4 Circuit for 110° deflection.

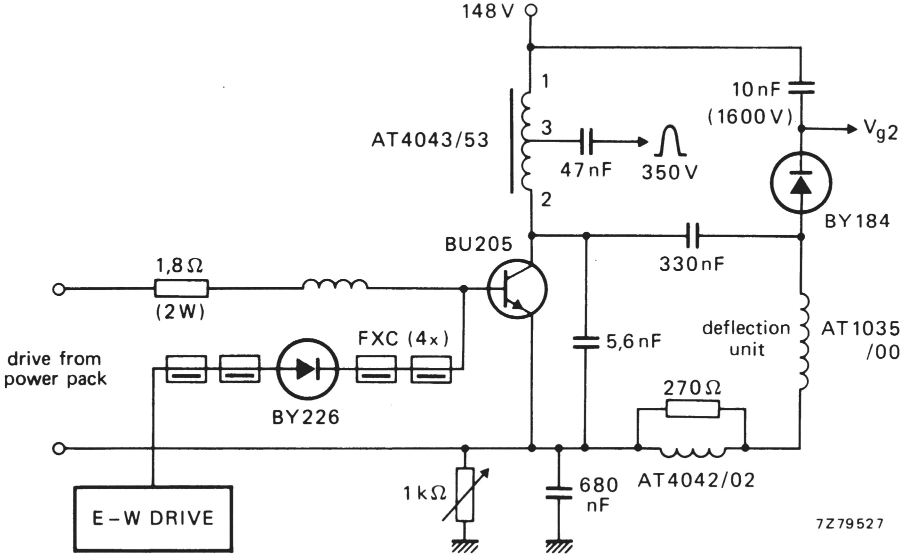

148 V
1
3
2
AT4043/53
47 nF
350 V
10 nF
(1600 V)
Vg2
BY184
BU205
330 nF
1,8 Ω
(2 W)
drive from
power pack
FXC (4x)
BY226
5,6 nF
deflection
unit
AT1035
/00
270 Ω
AT4042/02
1 kΩ
680
nF
E – W DRIVE
7Z79527

Fig. 5 Circuit for 90° deflection.

3122 138 93240

MAINS FILTER CHOKE FOR 1,5 A rms

APPLICATION

The AT4043/55 has been designed for use in consumer and professional equipment as part of the filter network in the power supply.

MECHANICAL DATA

The magnetic circuit of the filter choke comprises two Ferroxcube U25 cores. The unit is provided with four pins for mounting on a printed-wiring board.

Outlines

Dimensions in mm

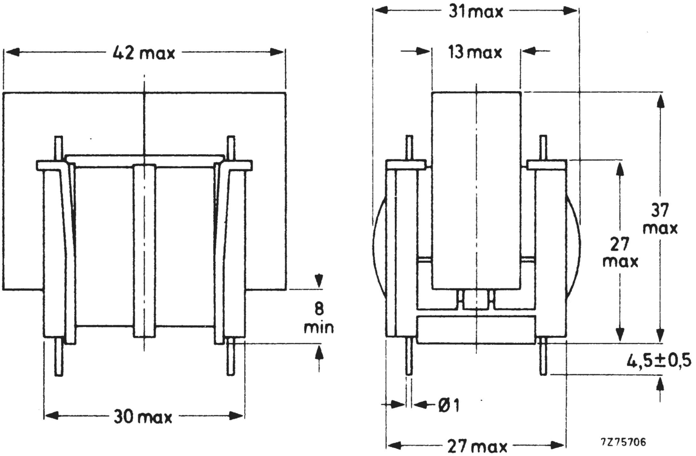

42 max
8
min
30 max
31max
13max
37
max
27
max
4,5±0,5
Ø1
27 max
7Z75706

Fig. 1.

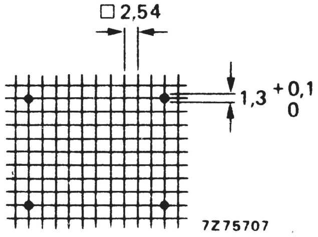

□2,54
1,3 +0,1
0
7Z75707

Fig. 2 Hole pattern for mounting on a printed-wiring board. Viewed from the solder side. The windings may be interchanged because the coil is symmetrical.

Marking

The catalogue number is printed on the Ferroxcube core.

ELECTRICAL DATA

Inductance, $L_{1\text{-}2} = L_{3\text{-}4}$	⩾ 25 mH
Resistance, $R_{1\text{-}2} = R_{3\text{-}4}$, at 25 °C	0,5 Ω
Leakage inductance	
$L_{s(1\text{-}2)}$, $L_{3\text{-}4}$ short-circuited	0,65 mH
$L_{s(3\text{-}4)}$, $L_{1\text{-}2}$ short-circuited	0,65 mH
Capacitance	37 pF
Maximum current (r.m.s.)	2 A
Maximum working temperature	115 °C

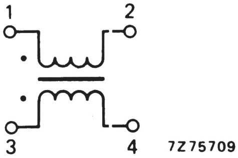

1
2
3
4
7Z75709

Fig. 3.

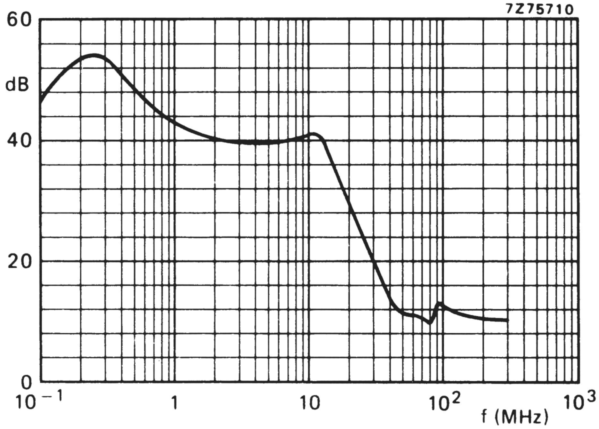


Fig. 4 Insertion loss measured in the 60 Ω circuit of Fig. 5.

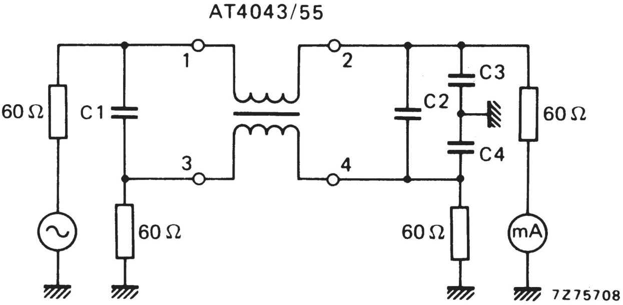

AT4043/55
1
2
3
4
60 Ω
C1
C2
C3
C4
60 Ω
60 Ω
60 Ω
mA
7Z75708

Fig. 5
C1 = C3 = C4 = 2200 pF, 250 V.
C2 = 0,47 μF, 250 V.

3122 138 91940 ←

SWITCHED-MODE DRIVER TRANSFORMER

APPLICATION

The AT4043/58 driver transformer has been designed for use in switched-mode power supply circuits for 90° colour television receivers, in conjunction with the switched-mode transformer AT2097/01.

MECHANICAL DATA

The magnetic circuit of the transformer comprises two Ferroxcube U15-cores. The item is provided with four pins for mounting on a printed-wiring board.

Outlines

Dimensions in mm

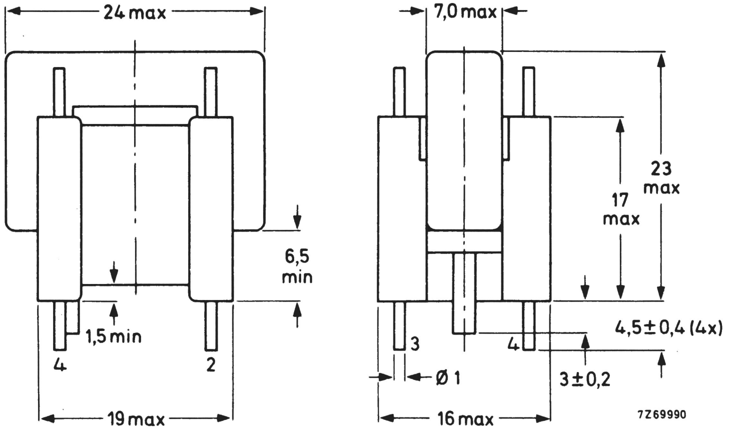

24 max
6,5 min
1,5 min
4
2
19 max
7,0 max
23 max
17 max
4,5±0,4 (4x)
3
4
Ø 1
3±0,2
16 max
7Z69990

Fig. 1.

Mounting

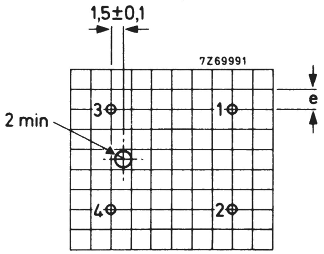

1,5±0,1
7Z69991
2 min
e
3
1
4
2

Fig. 2 Hole pattern for mounting on a printed-wiring board (component side). Hole diameter 1,3 + 0,1 mm. e = 2,54 mm (0,1 in).

ELECTRICAL DATA

Inductance primary (1-2) *	⩾ 220 mH
Resistance primary (1-2)	17,5 Ω
Resistance secondary (3-4)	0,27 Ω
Leakage inductance secondary (3-4)**	⩽ 5 μH
Transformation ratio 1-2/3-4	10
Maximum working temperature	115 °C

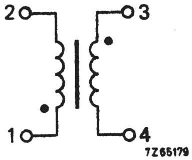


Fig. 3.

---

* Measuring conditions: E = 6 V; f = 1000 Hz.

** Measuring conditions: primary short-circuited; E = 250 mV; 1,1 ⩾ f ⩾ 0,9 MHz.

BRIDGE COIL

APPLICATION

The AT4043/68 is designed for the horizontal deflection output stage of 110° and 90° colour deflection systems. It is used in conjunction with the three-layer diode-split line output transformer AT2076/51 or AT2076/52.

MECHANICAL DATA (Dimensions in mm)

The coil is wound on a combination of two Ferroxcube U15-cores. It has four termination pins for mounting through a printed-wiring board.

Outlines

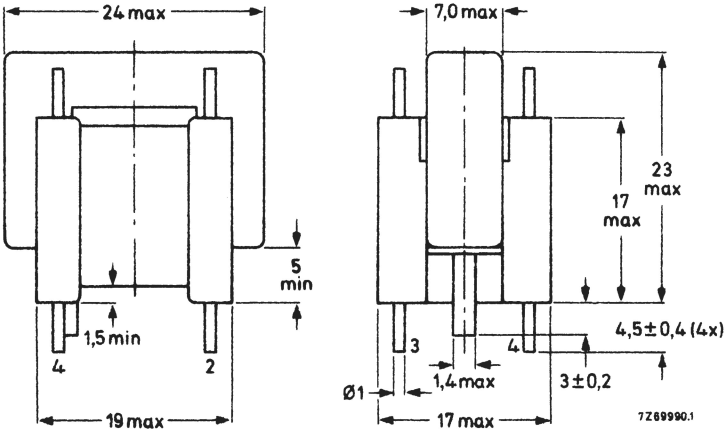

24 max
5 min
1,5 min
4
2
19 max
7,0 max
23 max
17 max
4,5±0,4 (4x)
3
4
Ø1
1,4 max
3±0,2
17 max
7Z69990.1

Fig. 1.

Mounting

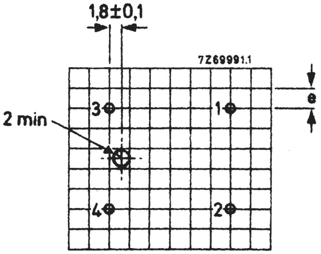

1,8±0,1
7Z69991.1
2 min
3
1
4
2
e

Fig. 2 Hole pattern for mounting on a printed-wiring board (component side). Hole diameter 1,3 + 0,1 mm. e = 2,54 mm (0,1 in).

ELECTRICAL DATA

Inductance*	0,52 mH ± 10%
Resistance	max. 0,6 Ω
Maximum peak-to-peak voltage	800 V
Maximum peak-to-peak current	2,9 A
Maximum working temperature	100 °C

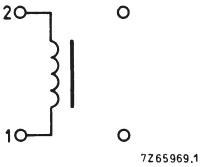


Fig. 3.

---

* Measuring conditions: E = 0,3 V; f = 1000 Hz.

3122 138 50000

INPUT CHOKE

- For single switch power pack system

APPLICATION

The AT4043/81 is for use as a supply choke in the single switch power pack system (S^2P^2) for colour TV receivers. It is used in conjunction with mains transformer TS561/2 or TS521B, mains filter choke AT4043/55, current sensing transformer AT4043/46, driver transformer AT4043/82 and diode-split line output transformer AT2076/80.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit comprises two Ferroxcube U25 cores, grade 3C8. The choke has 10 pins (ϕ1+0,1 mm, length 4,5 ± 0,5 mm) for mounting on a printed-wiring board. The maximum height of the choke is 36 mm.

Mounting

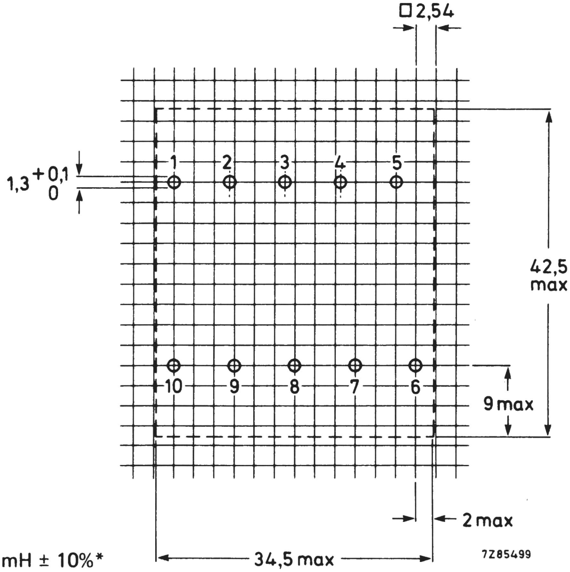


Fig. 1 Hole pattern for mounting on a printed-wiring board; viewed from the solder side.

ELECTRICAL DATA

Inductance (1-7)	25 mH ± 10%*
Resistance (1-4)	1,45 Ω ± 10%
Resistance (4-7)	1,85 Ω ± 10%
Resistance (10-3)	28 Ω ± 10%
Maximum peak current (1-7)	0,55 A
Maximum peak current (1-4)	1,1 A
Maximum working temperature	115 °C
Flammability	according to UL94, category V1

* Measuring conditions: E = 20 V, f = 1 kHz.

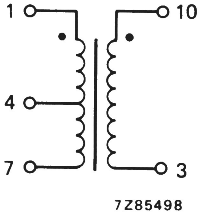


Fig. 2.

DRIVER TRANSFORMER

- For single switch power pack system
- Mains insulation

APPLICATION

The AT4043/82 is for use as a transistor driver transformer in the single switch power pack system (S^2P^2) for colour TV receivers. It is used in conjunction with mains transformer TS561/2 or TS521B, mains filter choke AT4043/55, current sensing transformer AT4043/46, input choke AT4043/81 and diode-split line output transformer AT2076/80.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit comprises two Ferroxcube U20 cores, grade 3C8. The primary and secondary windings are wound on a two-part coil former with large creepage distances and clearances, which ensure safe insulation between the mains and control circuits. The transformer has six pins for mounting on a printed-wiring board.

Outlines

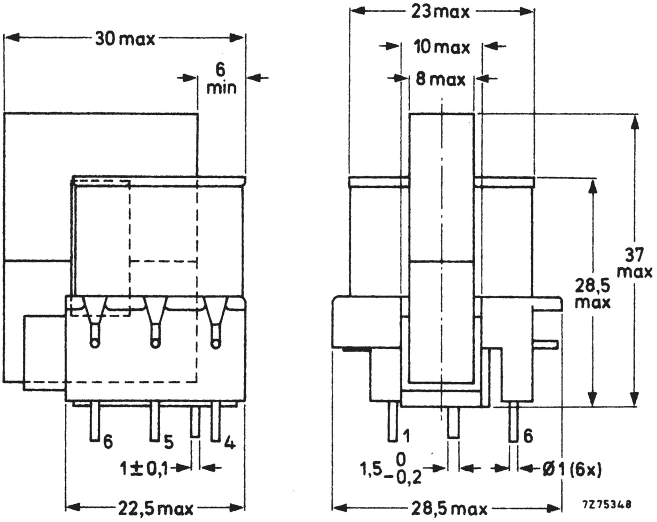


Fig. 1.

Mounting

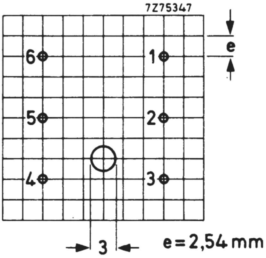


Fig. 2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

ELECTRICAL DATA

Inductance, primary (4-6)	⩾ 6,8 mH*
Resistance, primary (4-6), at 25 °C	2,6 Ω ± 10%
Leakage inductance, secondary (1-3)	17 μH ± 10%**
Resistance, secondary (1-3)	0,11 Ω ± 10%
Transformation ratio	3,24
Permissible current (r.m.s. value)	
primary (4-6)	200 mA
secondary (1-3)	500 mA
Mains isolation	according to IEC65
Breakdown voltage (d.c.)	
between secondary (1-3) and primary (4-6) or core	⩾ 5600 V
between primary (4-6) and core	⩾ 500 V
Maximum working temperature	115 °C

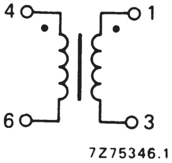


Fig. 3.

---

* Measuring condition: E = 3 V, f = 1 kHz.

** Measuring condition (primary short-circuited): E ⩽ 250 mV, 500 kHz ⩽ f ⩽ 600 kHz.

LINE DRIVER TRANSFORMER

APPLICATION

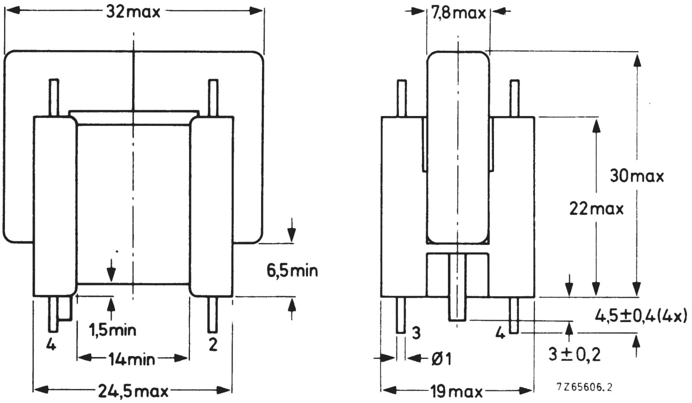
The transformer AT4043/87 has been designed for all-transistor black/white and colour television sets. In black and white television sets it can be used in the single-transistor (BU205) line-output circuit in conjunction with the line-output transformer AT2048/12; in colour television sets it can be used in the single-transistor (BU208A) line-output circuit in conjunction with the line-output transformer AT2076/30.

MECHANICAL DATA

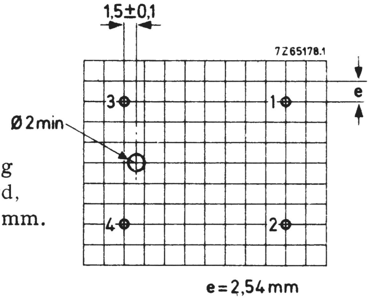
Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U-cores.
The unit is provided with pins for mounting on a printed-wiring board.

Outlines


32max
6,5min
1,5min
4
2
14min
24,5max
7,8max
30max
22max
4,5±0,4(4x)
3
4
3±0,2
Ø1
19max
7Z65606.2

Mounting

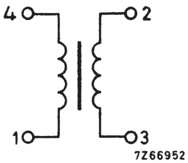


1,5±0,1
7Z65178.1
e
3
1
Ø2min
4
2
e=2,54mm

Hole pattern for mounting on a printed-wiring board, hole diameter 1, 3 + 0, 1 mm.

ELECTRICAL DATA

Inductance (primary, 1-4)	76 mH ± 12%
Leakage inductance (secondary) *)	≤ 2, 0 μH
Transformation ratio 4-1/2-3	29 : 1
Maximum working temperature	100 °C



4
2
1
3
7Z66952

---

*) Primary short circuited

E/W LOADING COIL

APPLICATION

This coil has been designed for the circuitry around the line output transformer AT2076/30 in conjunction with the deflection unit AT 1080 (see also the data on the transformer).

MECHANICAL DATA

Dimensions (mm)

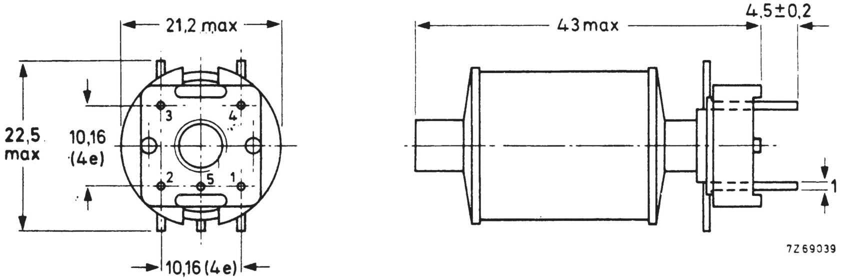

21,2 max
22,5 max
10,16 (4e)
3
4
2
5
1
10,16 (4e)
43 max
4,5±0,2
1
7Z69039

Fig. 1.

The coil is provided with pins for mounting on a printed-wiring board. It can be adjusted at the top by means of a trimming key.

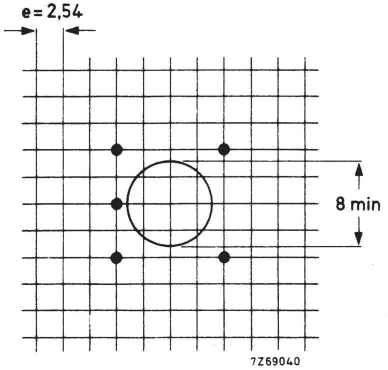

e = 2,54
8 min
7Z69040

Fig. 2 Hole pattern for mounting on a printed-wiring board, hole dia 1,3 + 0,1 mm

ELECTRICAL DATA

Inductance between 3 and 4 *)	1 to 5,3 mH
Resistance between 3 and 4	2 Ω
Maximum working temperature	95 °C

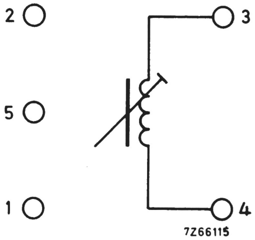


Fig. 3 Connection diagram

---

*) measured with 5000 pF in parallel.

LINE BALANCE COIL

APPLICATION

This coil has been designed for the circuitry of the four-pole unit incorporated in the deflection unit AT1080, for equalization of line and field astigmatism (see also data on AT1080)

MECHANICAL DATA

Dimensions (mm)

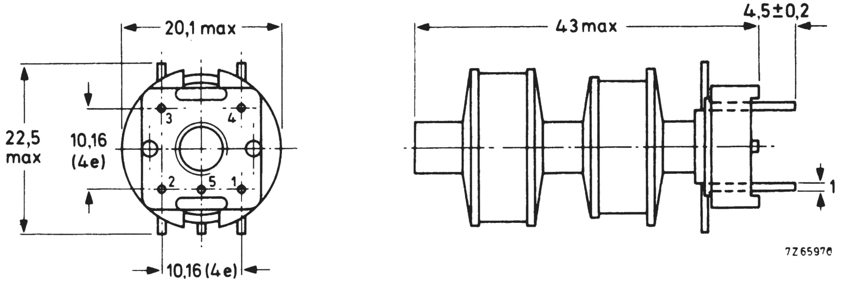

20,1 max
22,5 max
10,16 (4e)
3
4
2
5
1
10,16 (4e)
43max
4,5±0,2
1
7Z65970

Fig. 1

The coil is provided with pins for mounting on a printed-wiring board. It can be adjusted at the top by means of a trimming key.

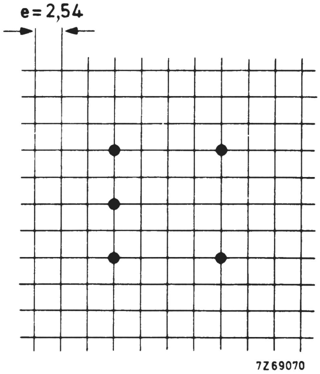

e = 2,54
7Z69070

Fig. 2 Hole pattern for mounting on a printed-wiring board, hole dia 1, 3 + 0, 1 mm

ELECTRICAL DATA

Inductance between 4 and 1 *)		13 to 63 μH
between 2 and 3		63 to 13 μH
Resistance between 4 and 1, and 2 and 3		0,15 Ω
Maximum working temperature		95 °C

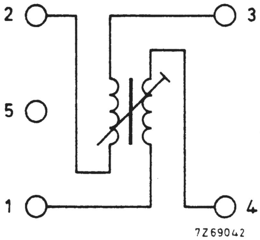


Fig. 3 Connection diagram

Pins 2 and 4 should be interconnected.

---

*) measured with 5000 pF in parallel.

FOUR-POLE ADJUSTING COIL

APPLICATION

This correction coil has been designed for the circuitry of the four-pole unit incorporated in the deflection unit AT1080, for equalization of line astigmatism (see also data on AT1080).

MECHANICAL DATA

Dimensions (mm)

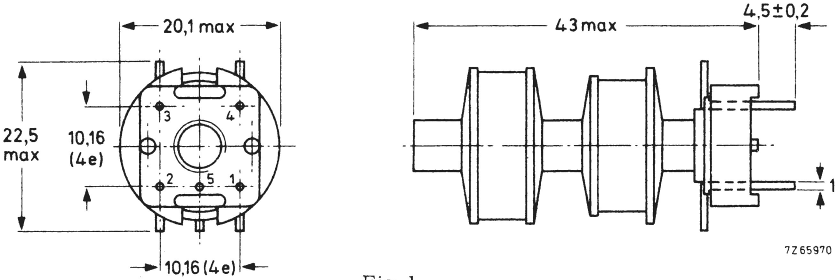

20,1 max
22,5 max
10,16 (4e)
3
4
2
5
1
10,16 (4e)
43 max
4,5±0,2
1
7Z65970

Fig. 1

The coil is provided with pins for mounting on a printed-wiring board. It can be adjusted at the top by means of a trimming key.

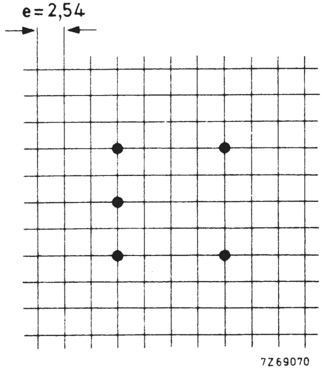

e = 2,54
7Z69070

Fig. 2 Hole pattern for mounting on a printed-wiring board, hole dia 1,3 + 0,1 mm

AT4044/27 | FOUR-POLE ADJUSTING COIL | 3122 138 72390

ELECTRICAL DATA

Inductance, measured with 5000 pF in parallel		
between 3 and 5	*)	33 to 150 μH
between 4 and 5	*)	150 to 33 μH
Resistance at 25 °C		
between 1 and 2		0,23 Ω
between 3 and 4		0, 18 Ω
Maximum working temperature		95 °C

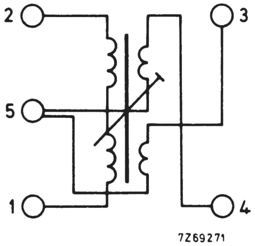


Fig. 3. Connection diagram

---

*) Supplied with core position for $L_{3-5} = L_{5-4} = 11,3\ \mu H \pm 5\%$.

3122 138 99420

LUMINANCE DELAY LINE

QUICK REFERENCE DATA

Delay	270 ns
Dimensions	30 x 19 x 14 mm
Self-extinguishing	

APPLICATION

The DL270 is for use in the luminance circuit of colour television receivers.

DESCRIPTION

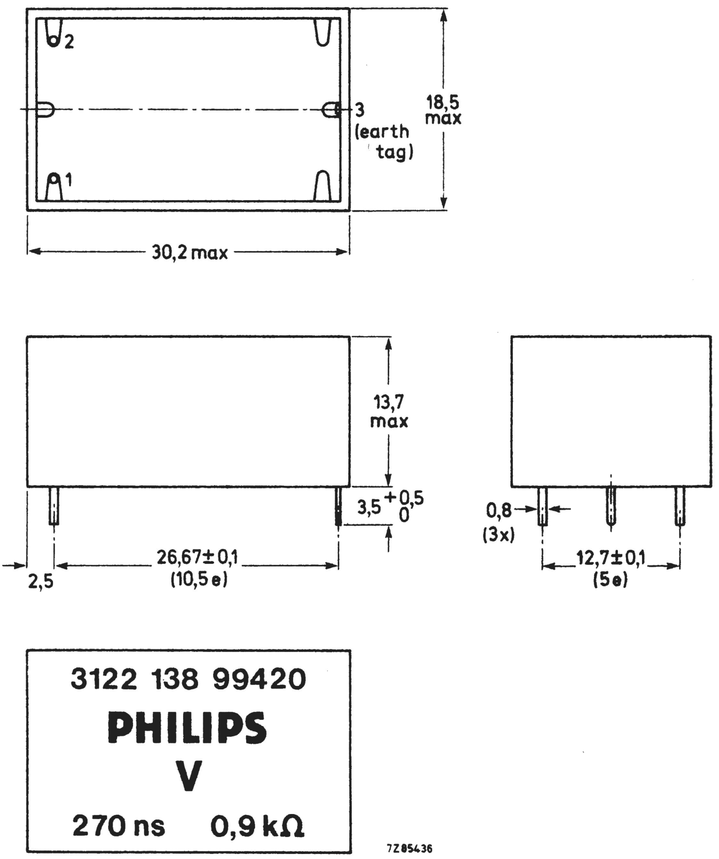
The delay line consists of two parallel connected coils which are astatically wound to decrease the influence of magnetic fields from other parts of the receiver. The delay line is in a plastic housing. Three pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Outlines

Dimensions in mm

e = 2,54 mm



2
3
(earth tag)
1
18,5 max
30,2 max
13,7 max
3,5 +0,5 0
2,5
26,67±0,1 (10,5 e)
0,8 (3x)
12,7±0,1 (5e)
3122 138 99420
PHILIPS
V
270 ns 0,9 kΩ
7Z85436

Fig. 1.

Mass 6,5 g

Mounting

The unit can be soldered onto a printed-wiring board pierced with three 1,0 + 0,1 mm diameter holes.

Packaging 108 delay lines per box.

ELECTRICAL DATA (Measured at 25 °C)

Delay	270 ns ± 10%
Characteristic impedance	0,9 kΩ ± 10%
Group delay (with respect to 0,5 MHz)	
at 3,5 MHz	max. 30 ns
at 5,0 MHz	max. 60 ns
Bandwidth at −3 dB	5 MHz
Ripple with 2τ-pulse on pin 2	max. 2,5%
Breakdown voltage between pins 2 and 3	min. 50 V (d.c.)
Permissible temperature range	−25 to + 70 °C

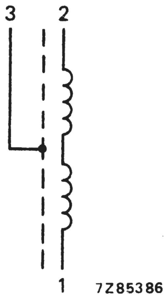


Fig. 2.

The luminance delay line withstands the following tests:

test	according to IEC 68-2 par.		procedure
Climatic			
cold	1	Ab	−25 °C, 96 h
dry heat	2	Bb	+ 70 °C, 96 h
damp heat cyclic	30	Db	+ 40 °C, 21 cycles
damp heat steady state	3	Ca	+ 40 °C, 21 days
change of temperature	14	Na	−25 °C/+ 70 °C, 5 cycles
Mechanical			
vibration sinusoidal	6	Fc	10-55-10 Hz, amplitude 0,35 mm 3 perpendicular directions, 0,5 h each
bump	29	Eb	1000 bumps in 6 directions peak acceleration 245 m/s^2
shock	27	Ea	half-sinewave, 11 ms peak acceleration 490 m/s^2 3 shocks per direction, 6 directions
resistance to soldering heat	20	Tb	method 1A
solderability	20	Ta	first part of method 1 230 ± 10 °C, 2 ± 0,5 s
robustness of terminations	21	Ua Ub	tensile 10 N, thrust 2 N 2 bends, 5 N

3122 138 96042

LUMINANCE DELAY LINE

QUICK REFERENCE DATA

Delay	330 ns
Dimensions	30 x 19 x 14 mm
Self-extinguishing properties	

APPLICATION

The DL330 is for use in the luminance circuit of colour television receivers.

DESCRIPTION

The delay line consists of two parallel connected coils which are astatically wound to decrease the influence of magnetic fields from other parts of the receiver. The delay line is enclosed in a plastic housing. Three pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Outlines

Dimensions in mm

e = 2,54 mm

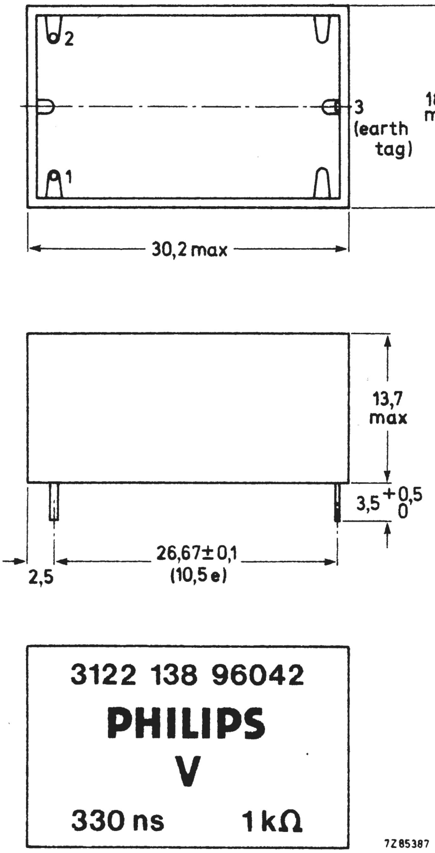

2
3
(earth tag)
1
18,5 max
30,2 max
13,7 max
3,5 +0,5 0
26,67±0,1 (10,5 e)
2,5
0,8 (3x)
12,7±0,1 (5e)
3122 138 96042
PHILIPS
V
330 ns
1 kΩ
7Z85387

Fig. 1.

Mass 6,5 g

Mounting

The unit can be soldered directly onto a printed-wiring board pierced with three 1,0 + 0,1 mm diameter holes.

Packaging 108 delay lines per box.

ELECTRICAL DATA

Measured at 25 °C

Delay	330 ns ± 10%
Characteristic impedance	1 kΩ ± 10%
Group delay (with respect to 0,5 MHz)	
at 3,5 MHz	max. 30 ns
at 5,0 MHz	max. 60 ns
Bandwidth at −3 dB	5 MHz
Ripple with 2τ-pulse on pin 2	max. 2,5%
Breakdown voltage between pins 2 and 3	min. 50 V (d.c.)
Permissible temperature range	−25 to +70 °C

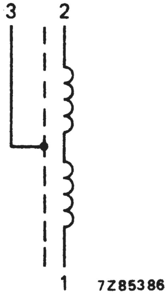


Fig. 2.

The luminance delay line withstands the following tests:

test	according to IEC 68-2 par.		procedure
Climatic			
cold	1	Ab	−25 °C, 96 h
dry heat	2	Bb	+70 °C, 96 h
damp heat cyclic	30	Db	+40 °C, 21 cycles
damp heat steady state	3	Ca	+40 °C, 21 days
change of temperature	14	Na	−25 °C/+70 °C, 5 cycles
Mechanical			
vibration sinusoidal	6	Fc	10-55-10 Hz, amplitude 0,35 mm 3 perpendicular directions, 0,5 h each
bump	29	Eb	1000 bumps in 6 directions peak acceleration 245 m/s²
shock	27	Ea	half-sinewave, 11 ms peak acceleration 490 m/s² 3 shocks per direction, 6 directions
resistance to soldering heat	20	Tb	method 1A
solderability	20	Ta	first part of method 1 230 ± 10 °C, 2 ± 0,5 s
robustness of terminations	21	Ua Ub	tensile 10 N, thrust 2 N 2 bends, 5 N

3122 138 99471

LUMINANCE DELAY LINE

QUICK REFERENCE DATA

Delay	470 ns
Dimensions	30 x 19 x 14 mm
Self-extinguishing	

APPLICATION

The DL470 is for use in the luminance circuit or transposer circuit of colour television receivers.

DESCRIPTION

The delay line consists of two parallel connected coils which are astatically wound to decrease the influence of magnetic fields from other parts of the receiver. The delay line is in a plastic housing. Three pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

Outlines

e = 2,54 mm

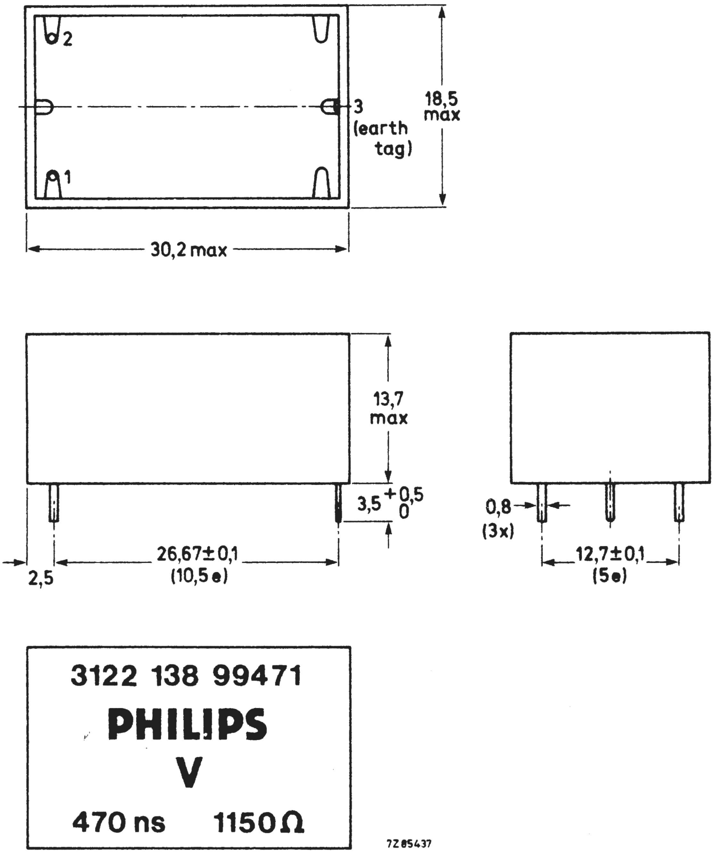

2
3
(earth tag)
1
18,5 max
30,2 max
13,7 max
3,5 +0,5 0
2,5
26,67±0,1 (10,5 e)
0,8 (3x)
12,7±0,1 (5e)
3122 138 99471
PHILIPS
V
470 ns 1150Ω
7Z85437

Fig. 1.

Mass 6,5 g

Mounting

The unit can be soldered onto a printed-wiring board pierced with three 1,0 + 0,1 mm diameter holes.

Packaging 108 delay lines per box.

ELECTRICAL DATA (Measured at 25 °C)

Delay	470 ns ± 10%
Characteristic impedance	1150 Ω ± 10%
Group delay (with respect to 1,0 MHz)	
at 3,5 MHz	max. 45 ns
at 5,0 MHz	max. 60 ns
Bandwidth at –3 dB	5 MHz
Ripple with 2τ-pulse on pin 2	max. 3%
Breakdown voltage between pins 2 and 3	min. 50 V (d.c.)
Permissible temperature range	–25 to + 70 °C

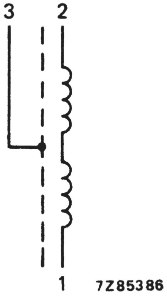


Fig. 2.

The luminance delay line withstands the following tests:

test	according to IEC 68-2 par.		procedure
Climatic			
cold	1	Ab	–25 °C, 96 h
dry heat	2	Bb	+ 70 °C, 96 h
damp heat cyclic	30	Db	+ 40 °C, 21 cycles
damp heat steady state	3	Ca	+ 40 °C, 21 days
change of temperature	14	Na	–25 °C/+ 70 °C, 5 cycles
Mechanical			
vibration sinusoidal	6	Fc	10-55-10 Hz, amplitude 0,35 mm 3 perpendicular directions, 0,5 h each
bump	29	Eb	1000 bumps in 6 directions peak acceleration 245 m/s^2
shock	27	Ea	half-sinewave, 11 ms peak acceleration 490 m/s^2 3 shocks per direction, 6 directions
resistance to soldering heat	20	Tb	method 1A
solderability	20	Ta	first part of method 1 230 ± 10 °C, 2 ± 0,5 s
robustness of terminations	21	Ua Ub	tensile 10 N, thrust 2 N 2 bends, 5 N

4322 027 84620

DELAY LINE

QUICK REFERENCE DATA

For receivers up to European PAL standard	
Nominal frequency	4,433619 MHz
Phase delay time	63,943 μs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL600 is intended for use in decoder circuits of colour television receivers.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

Outlines

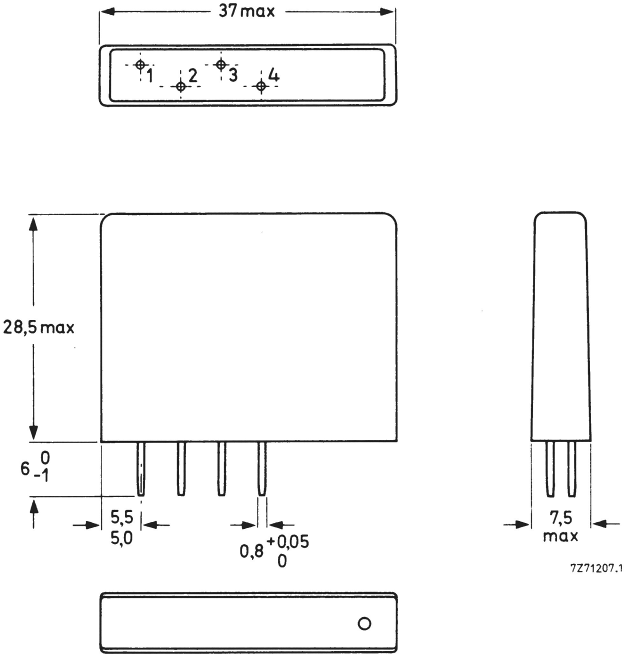

37 max
1
2
3
4
28,5 max
6 0 -1
5,5
5,0
0,8 +0,05 0
7,5
max
7Z71207.1

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

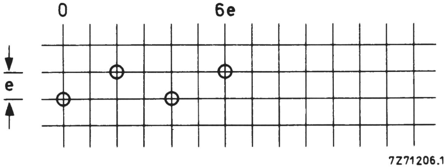

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	4,433619 MHz
Phase delay time (τ)	63,943 ± 0,005 μs
Bandwidth at −3 dB	from $\leqslant$ 3,43 to $\geqslant$ 5,23 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from +10 to +60 °C (relative to +25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals	
3 τ signals	$\leqslant$ −30 dB with respect to 1 τ signal
other signals	$\leqslant$ −30 dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	180°
Storage temperature range	−40 to +70 °C

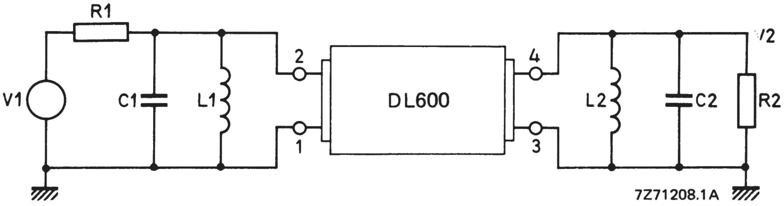


Fig. 3.

Terminations

R1 = R2 = 560 Ω

C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring capacitance, capacitance of
C2 = 30 pF } coil and extra trimming capacitor.

L1 = 10,5 μH

L2 = 9,7 μH

Application circuit

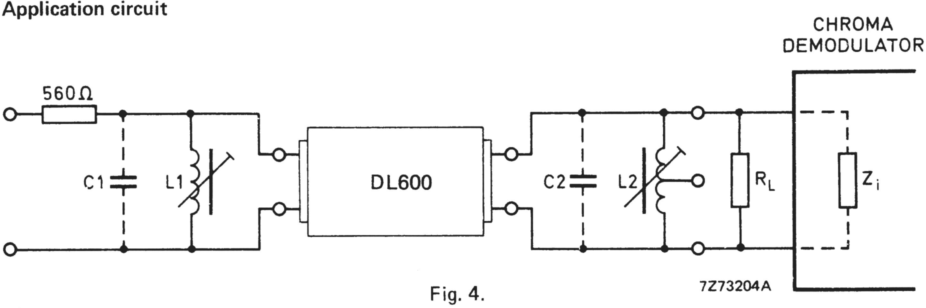

CHROMA
DEMODULATOR
560Ω
C1
L1
DL600
C2
L2
R_L
Z_i
7Z73204A

Fig. 4.

$(R_L//Z_i) = 560\ \Omega$

C1, C2 <30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal values depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_o L_1}{1 - \omega_o^2\ L1C1} = 350\ \Omega$$

$$X2 = \frac{\omega_o L_2}{1 - \omega_o^2\ L2C2} = 350\ \Omega$$

$f_o = 4{,}433619$ MHz.

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to +36%.

4322 027 84640

DELAY LINE

QUICK REFERENCE DATA

For receivers up to European PAL and SECAM standard	
Nominal frequency	4,433619 MHz
Phase delay time	63,943 μs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL610 is intended for use in decoder circuits of colour television receivers.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA Dimensions in mm

Outlines

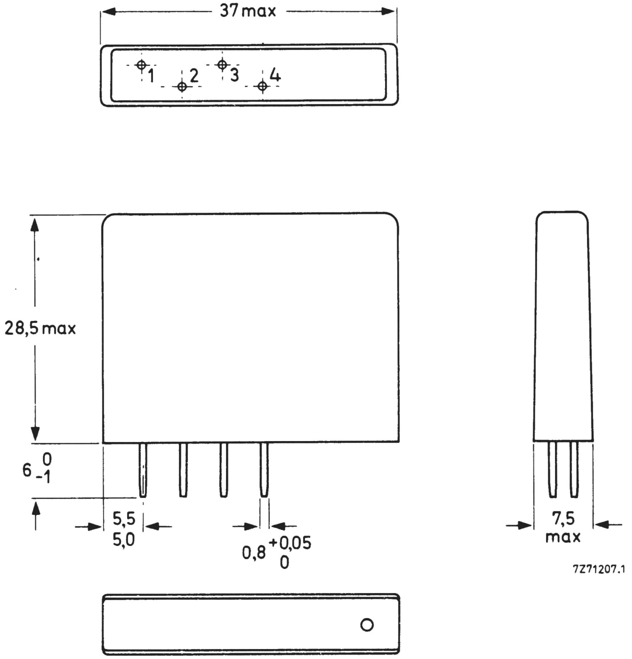

37 max
1
2
3
4
28,5 max
6 0 -1
5,5
5,0
0,8 +0,05 0
7,5 max
7Z71207.1

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

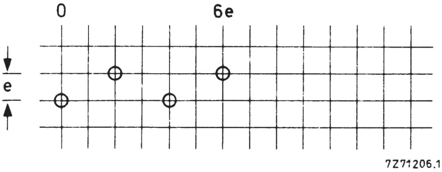

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	4,433619 MHz
Phase delay time (τ)	63,943 ± 0,005 μs
Bandwidth at –3 dB	from $\leqslant$ 3,43 to $\geqslant$ 5,23 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from + 10 to + 60 °C (relative to + 25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals *	
3 τ signals	$\leqslant$ –30 dB with respect to 1 τ signal
other signals	$\leqslant$ –30 dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	180°
Storage temperature range	–40 to + 70 °C

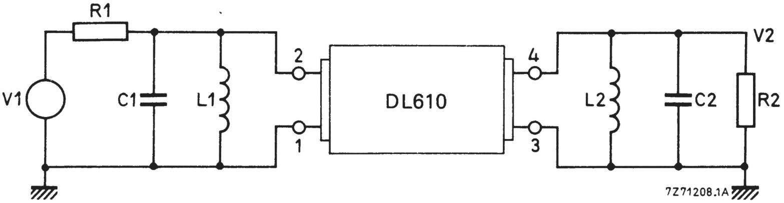


Fig. 3.

Terminations
R1 = R2 = 560 Ω
C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring
C2 = 30 pF } capacitance, capacitance of coil and extra trimming capacitor.
L1 = 10,5 μH
L2 = 9,7 μH

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* Measured in frequency range 3,9 to 4,75 MHz.

Application circuit

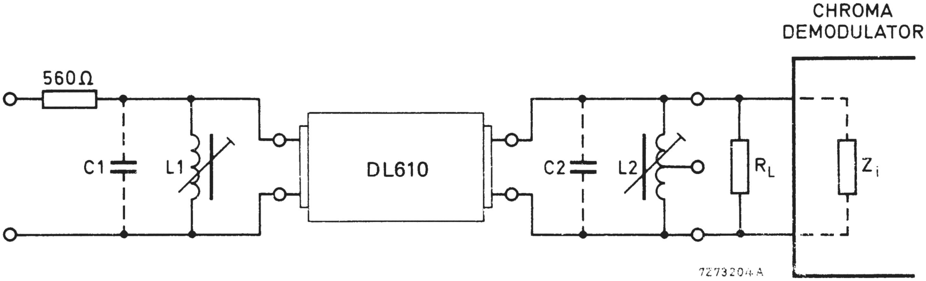

CHROMA
DEMODULATOR
560Ω
C1
L1
DL610
C2
L2
R_L
Z_i
7273204.A

Fig. 4.

$(R_L//Z_i)$ = 560 Ω

C1, C2 <30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal values depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_0 L1}{1-\omega_0^2 L1C1} = 350\ \Omega$$

$$X2 = \frac{\omega_0 L2}{1-\omega_0^2 L2C2} = 350\ \Omega$$

$$f_0 = 4,433619\ \text{MHz}$$

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to + 36%.

4322 027 84700

DELAY LINE

QUICK REFERENCE DATA

For receivers up to European PAL standard	
Nominal frequency	4,433619 MHz
Phase delay time	63,943 μs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL700 is intended for use in decoder circuits of colour television receivers.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

---

*Will be replaced by DL701 with 3 dB better spurious signal suppression. ←

MECHANICAL DATA

Dimensions in mm

Outlines

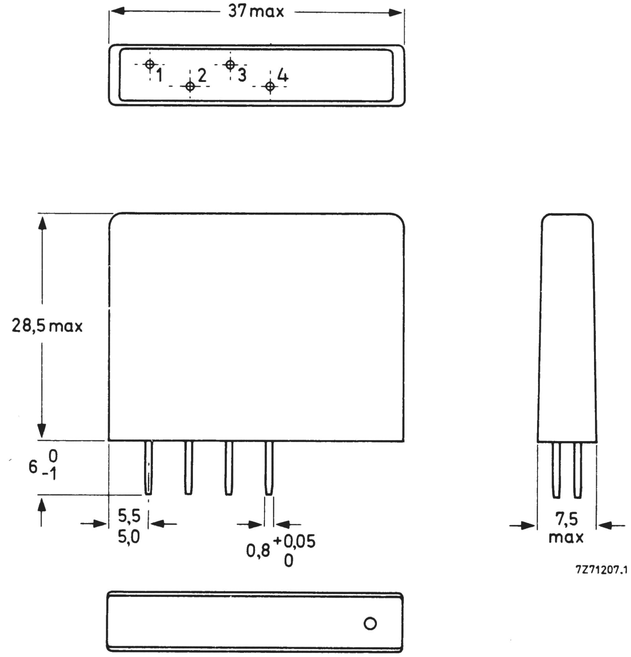

37 max
1
2
3
4
28,5 max
6 $^{0}_{-1}$
5,5
5,0
0,8 $^{+0,05}_{0}$
7,5
max
7Z71207.1

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

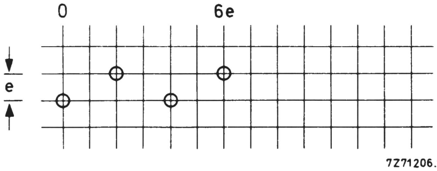

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	4,433619 MHz
Phase delay time (τ)	63,943 ± 0,005 μs
Bandwidth at –3 dB	from $\leqslant$ 3,43 to $\geqslant$ 5,23 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from + 10 to + 60 °C (relative to + 25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals	
3 τ signals	$\leqslant$ –30 dB with respect to 1 τ signal
other signals	$\leqslant$ –30 dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	180°
Storage temperature range	–40 to +70 °C

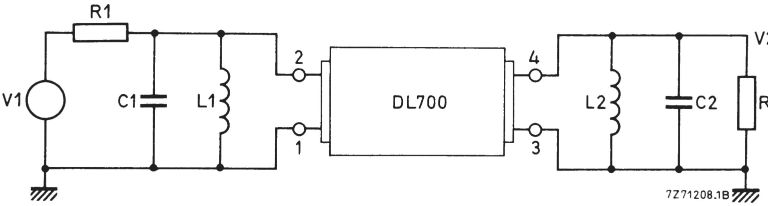


Fig. 3.

Terminations
R1 = R2 = 390 Ω
C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring capacitance,
C2 = 30 pF } capacitance of coil and extra trimming capacitor.
L1 = 8,64 μH
L2 = 8,10 μH

Application circuit

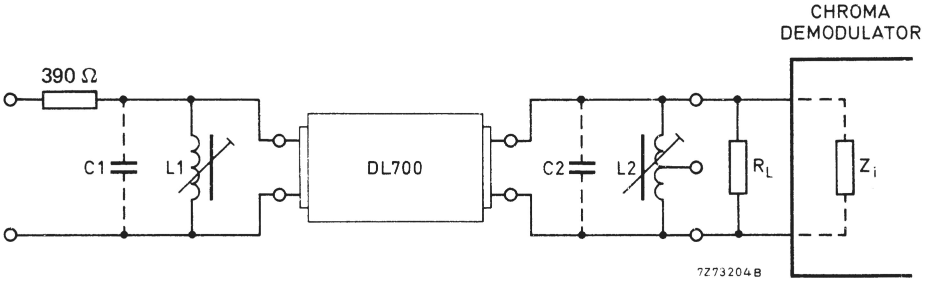

CHROMA
DEMODULATOR
390 Ω
C1
L1
DL700
C2
L2
R_L
Z_i
7Z73204B

Fig. 4.

$(R_L // Z_i) = 390\ \Omega$

C1, C2 < 30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal values depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_0 L1}{1 - \omega_0^2 L1C1} = 278\ \Omega$$

$$X2 = \frac{\omega_0 L2}{1 - \omega_0^2 L2C2} = 278\ \Omega$$

$$f_0 = 4{,}433619\ \text{MHz}$$

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to + 36%.

4322 027 84710

DELAY LINE

QUICK REFERENCE DATA

For receivers up to European PAL and SECAM standard	
Nominal frequency	4,433619 MHz
Phase delay time	63,943 μs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL710 is intended for use in decoder circuits of colour television receivers.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

---

*Will be replaced by DL711 with 3 dB better spurious signal suppression. ←

MECHANICAL DATA

Dimensions in mm

Outlines

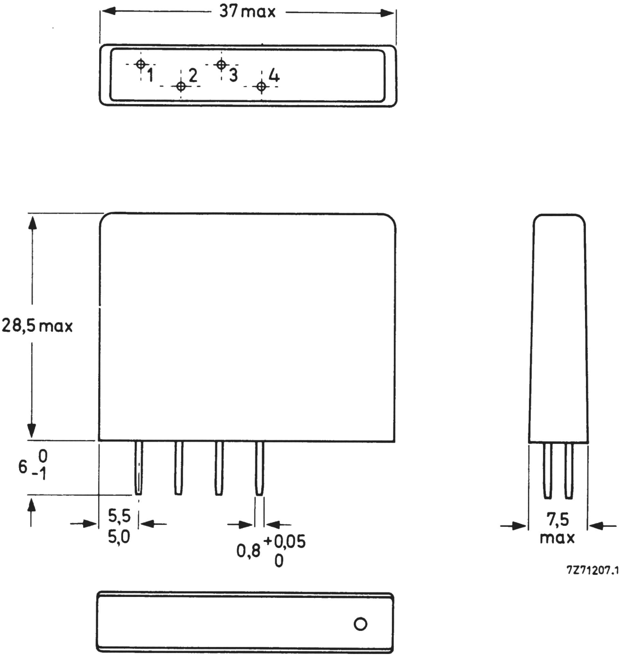

37 max
1
2
3
4
28,5 max
$6^{\ 0}_{-1}$
5,5
5,0
$0,8^{+0,05}_{\ 0}$
7,5
max
7Z71207.1

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

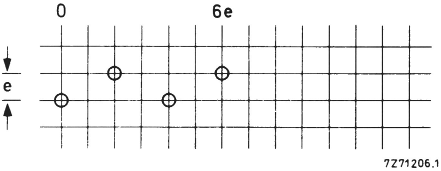

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	4,433619 MHz
Phase delay time (τ)	63,943 ± 0,005 μs
Bandwidth at −3 dB	from $\leqslant$ 3,43 to $\geqslant$ 5,23 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from +10 to + 60 °C (relative to + 25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals*	
3 τ signals	$\leqslant$ −30 dB with respect to 1 τ signal
other signals	$\leqslant$ −30 dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	180°
Storage temperature range	−40 to + 70 °C

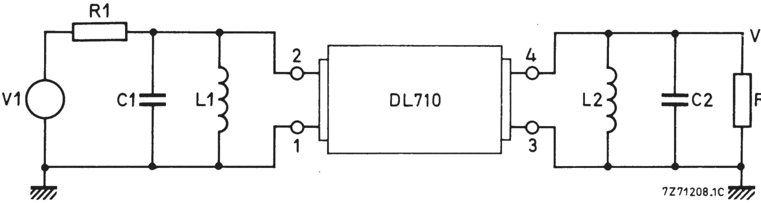


Fig. 3.

Terminations

R1 = R2 = 390 Ω

C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring capacitance,
C2 = 30 pF } capacitance of coil and extra trimming capacitor.

L1 = 8,64 μH

L2 = 8,10 μH

---

* Measured in frequency range 3,9 to 4,75 MHz.

Application circuit

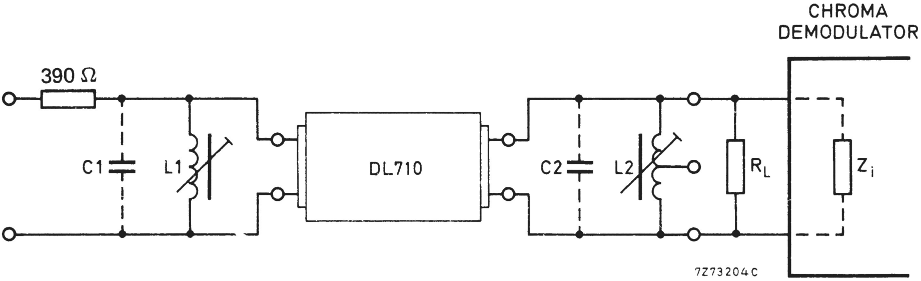

CHROMA
DEMODULATOR
390 Ω
C1
L1
DL710
C2
L2
R_L
Z_i
7Z73204C

Fig. 4.

$(R_L//Z_i)$ = 390 Ω

C1, C2 < 30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal values depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_o L1}{1-\omega_o^2 L1C1} = 278\ \Omega$$

$$X2 = \frac{\omega_o L2}{1-\omega_o^2 L2C2} = 278\ \Omega$$

f_o = 4,433619 MHz

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to + 36%.

4322 027 84720

DELAY LINE

QUICK REFERENCE DATA

For receivers up to Argentine PAL-N standard	
Nominal frequency	3,582056 MHz
Phase delay time	63,929 µs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL720 is intended for use in decoder circuits of colour television receivers.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

Outlines

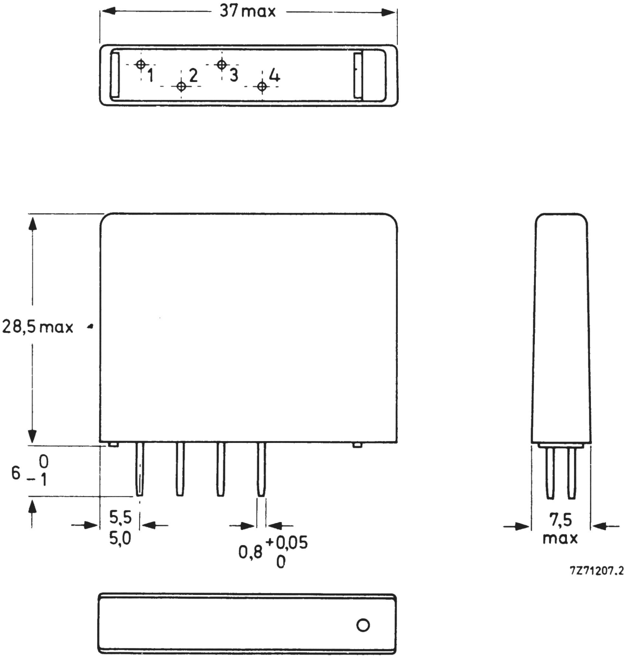

37 max
1
2
3
4
28,5 max
6 0 −1
5,5
5,0
0,8 +0,05 0
7,5 max
7Z71207.2

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

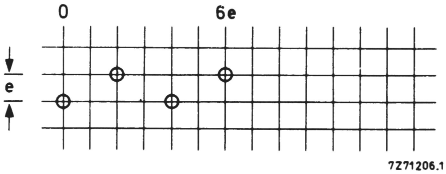

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	3,582056 MHz
Phase delay time (τ)	63,929 ± 0,004 μs
Bandwidth at −3 dB	from $\leqslant$ 2,8 to $\geqslant$ 4,5 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from +10 to +60 °C (relative to +25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals	
3 τ signals	$\leqslant -22$ dB with respect to 1 τ signal
other signals	$\leqslant -28$ dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	0°
Storage temperature range	−40 to +70 °C

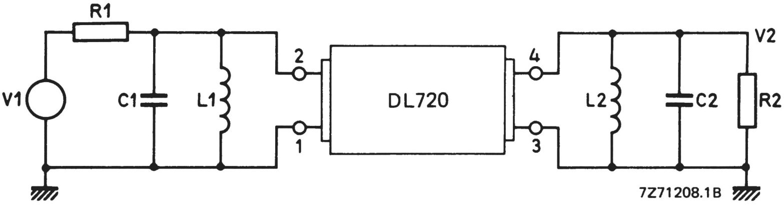


Fig. 3.

Terminations

R1 = R2 = 560 Ω

C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring capacitance,
C2 = 30 pF } capacitance of coil and extra trimming capacitor.

L1 = 15,2 μH

L2 = 14,1 μH

Application circuit

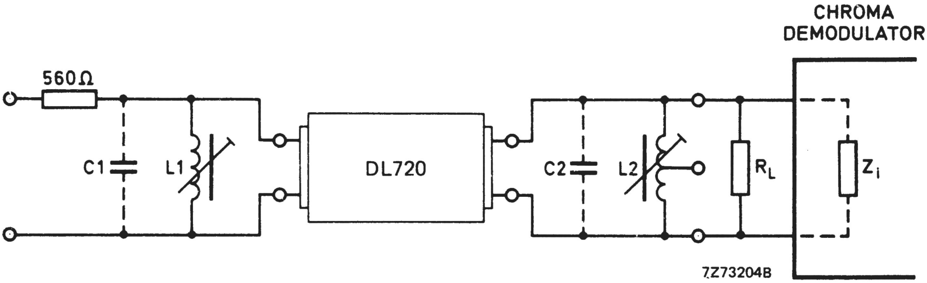

CHROMA
DEMODULATOR
560Ω
C1
L1
DL720
C2
L2
R_L
Z_i
7Z73204B

Fig. 4.

$(R_L//Z_i) = 560\ \Omega$

C1, C2 < 30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal valyes depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_o L1}{1 - \omega_o^2 L1C1} = 405\ \Omega$$

$$X2 = \frac{\omega_o L2}{1 - \omega_o^2 L2C2} = 405\ \Omega$$

$$f_o = 3{,}582056\ \text{MHz}.$$

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to +36%.

4322 027 84750

DELAY LINE

QUICK REFERENCE DATA

Nominal frequency	3,579545 MHz
Phase delay time	63,555 µs
Dimensions	37 x 7,5 x 28,5 mm
Self-extinguishing properties	

APPLICATION

The DL750 is intended for use as a comb filter in colour television receivers to NTSC standard.

DESCRIPTION

A very thin slab of zero TC glass provided with two transducers is shock-proof mounted in a housing with self-extinguishing properties. Four pins enable the unit to be soldered directly onto a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

Outlines

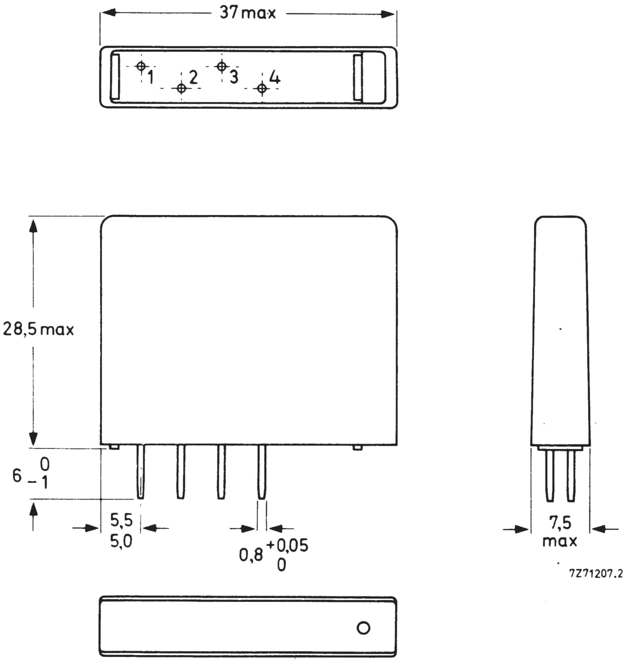

37 max
1
2
3
4
28,5 max
6 $^{0}_{-1}$
5,5
5,0
0,8 $^{+0,05}_{0}$
7,5
max
7Z71207.2

Fig. 1.

Mass 7 g

Mounting

The unit can be soldered directly onto a printed-wiring board.

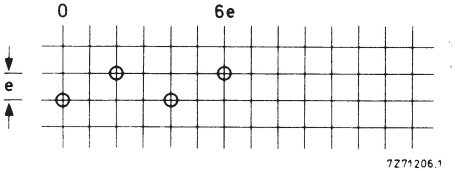

0
6e
e
7Z71206.1

Fig. 2 Recommended hole pattern for mounting on a printed-wiring board: e = 2,54 mm. The tolerance on the distances of the different holes to the 0-line is ± 0,1 mm. Hole diameter is 1,0 + 0,1 mm.

ELECTRICAL DATA

Measured with the circuit of Fig. 3 at 25 °C and f_o (unless otherwise specified)

Nominal frequency (f_o)	3,579545 MHz
Phase delay time (τ)	63,555 ± 0,004 μs
Bandwidth at −3 dB	from $\leqslant$ 2,8 to $\geqslant$ 4,5 MHz
Insertion loss	9 ± 3 dB
Drift of phase delay from +10 to +60 °C (relative to +25 °C)	max. 5 ns, typ. 3 ns
Maximum input voltage (p-p)	10 V
Spurious signals	
3 τ signals	$\leqslant$ −30 dB with respect to 1 τ signal ←
other signals	$\leqslant$ −28 dB with respect to 1 τ signal
Phase relation $\varphi_{4\text{-}3} - \varphi_{2\text{-}1}$	180°
Storage temperature range	−40 to +70 °C

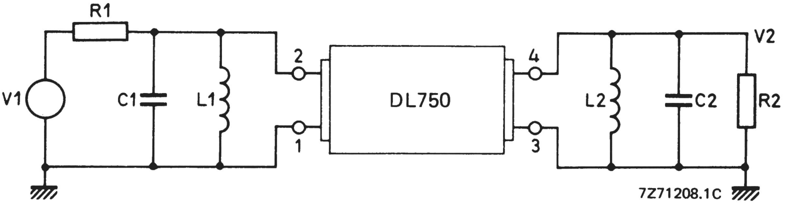


Fig. 3.

Terminations

R1 = R2 = 560 Ω

C1 = 20 pF } total capacitance of test jig without delay-line i.e. wiring capacitance,
C2 = 30 pF } capacitance of coil and extra trimming capacitor.

L1 = 15,2 μH
L2 = 14,1 μH

Application circuit

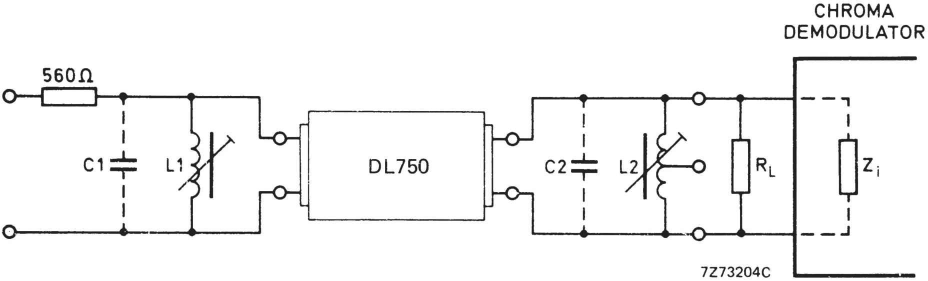

CHROMA
DEMODULATOR
560Ω
C1
L1
DL750
C2
L2
R_L
Z_i
7Z73204C

Fig. 4.

$(R_L//Z_i) = 560\ \Omega$

C1, C2 < 30 pF (wiring capacitance and capacitance of the coil)

L1, L2 nominal values depend on values of C1 and C2 to produce the reactances:

$$X1 = \frac{\omega_0 L1}{1 - \omega_0^2\, L1C1} = 405\ \Omega$$

$$X2 = \frac{\omega_0 L2}{1 - \omega_0^2\, L2C2} = 405\ \Omega$$

$$f_0 = 3{,}579545\ \text{MHz}.$$

Maximum bandwidth is obtained at minimum C1 and C2.

Recommended adjustment range of the coils −19 to +36%.

3112 318 36191

MAINS TRANSFORMER

APPLICATION

The TS561/2 is a supply transformer for colour television receivers with the power pack system. It is also suitable in many semi-professional and professional applications.

MECHANICAL DATA

The transformer has a laminated iron core with a stacking height of max. 19,5 mm. The item is provided with 4 primary pins and 3 secondary pins for mounting on a printed-wiring board. Mounting facility with 4 self-tapping screws is provided.

Outlines

Dimensions in mm

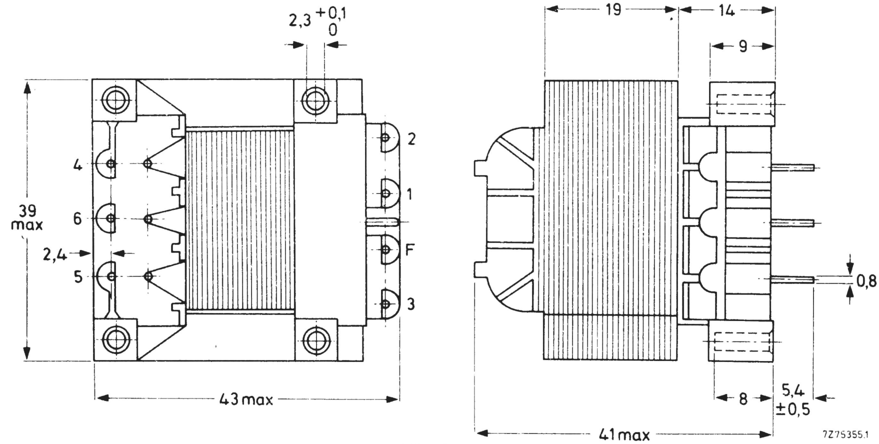

2,3 +0,1 0
39 max
2,4
4
6
5
2
1
F
3
43 max
19
14
9
0,8
8
5,4 ±0,5
41 max
7Z75355.1

Fig. 1.

Mass 160 g

Mounting

The transformer is secured by means of four self-tapping screws of 3 mm.

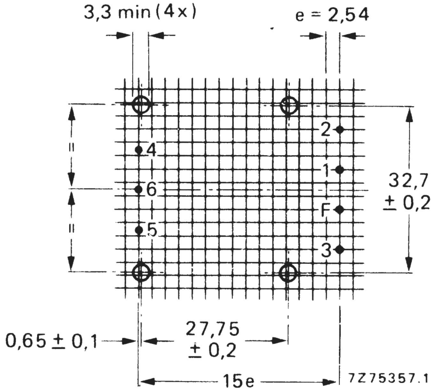

3,3 min (4x)
e = 2,54
2
4
1
6
F
5
3
32,7 ± 0,2
0,65 ± 0,1
27,75 ± 0,2
15e
7Z75357.1

Fig. 2 Hole pattern for mounting on a printed-wiring board; hole diameter 1 + 0,1 mm. Viewed from the solder side.

ELECTRICAL DATA

Input power at $T = 115\ ^{o}C$ ($T_{amb} = 60\ ^{o}C$)		6,5 VA
Output power at $T = 115\ ^{o}C$ ($T_{amb} = 60\ ^{o}C$)		3,22 W

Note: for over-temperature protection a built-in temperature fuse (123 ^{o}C) is used; connection F.

Primary voltage,	(2 – F)	110 V
	(3 – F)	220 V
Primary resistance at $T_{amb} = 25\ ^{o}C$	(3 – F)	1140 Ω
Secondary voltage V_o at $I_o = 80$ mA	(4 – 6 = 6 – 5)	17,4 V, see Fig. 4
Secondary resistance at $T_{amb} = 25\ ^{o}C$		19 Ω
Test voltage between primary and case (d.c.)		5600 V
Test voltage between secondary and case (d.c.)		500 V
Mains isolation		acc. to IEC 65

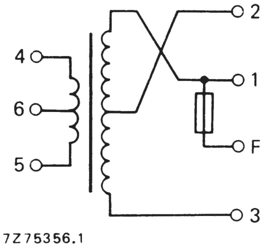


Fig. 3 Diagram and connections.

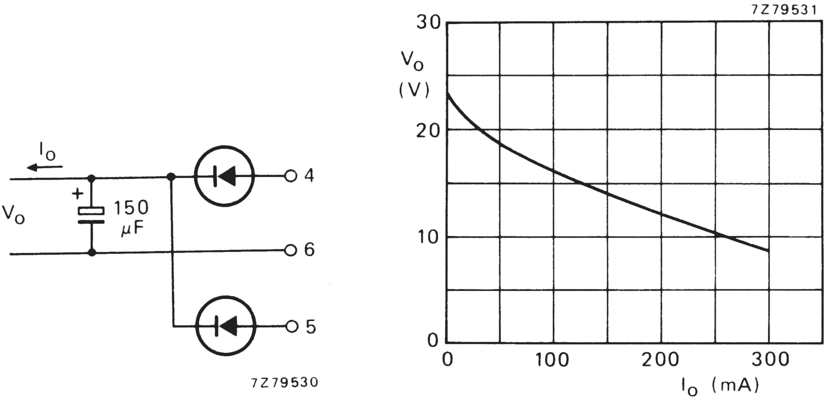


Fig. 4 Output voltage V_o as a function of the load current I_o.

MAINS TRANSFORMER

- For single switch power pack system
- 8 VA output power

APPLICATION

The TS521B is a supply transformer for colour television receivers with the single switch power pack (S^2P^2) system. It is also suitable in many semi-professional applications.

MECHANICAL DATA

Dimensions in mm

The transformer has a laminated iron core with a stacking height of max. 18,7 mm. It has 3 primary pins and 4 secondary pins for mounting on a printed-wiring board. Mounting facility with 4 self-tapping screws is provided.

Outlines

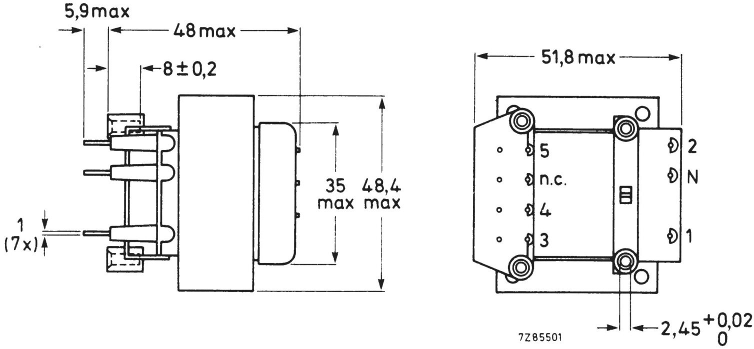

5,9max
48max
8 ± 0,2
1
(7x)
35 max
48,4 max
51,8 max
5
n.c.
4
3
2
N
1
2,45 +0,02 0
7Z85501

Fig. 1.

Mass 285 g

Mounting

The transformer is secured by means of four self-tapping screws 4 N x 5/16.

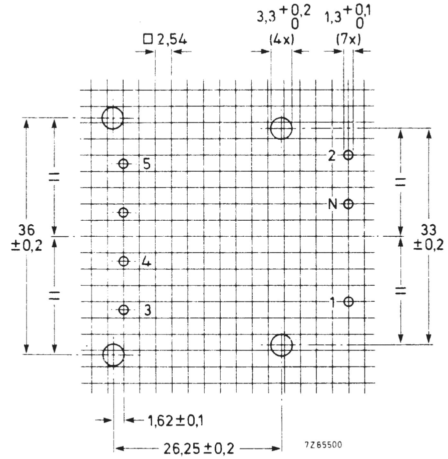


Fig. 2 Hole pattern for mounting on a printed-wiring board, viewed from solder side.

ELECTRICAL DATA

Input power at T = 115 °C (T_{amb} = 60 °C)	12 VA
Output power at T = 115 °C (T_{amb} = 60 °C)	8 VA

Note: for over-temperature protection a built-in temperature fuse (123 °C) is used; connection N (Fig. 1).

Primary voltage	(N-2)	220/240 V
Primary resistance at T_{amb} = 25 °C	(N-2)	400 Ω
Secondary voltage	(3-4 = 4-5)	25,2 V
Secondary resistance at T_{amb} = 25 °C	(3-5)	28 Ω
Test voltage (d.c.)		
between primary and secondary		5600 V
between primary and core		5600 V
between secondary and core		500 V
Insulation resistance		
between primary and secondary		> 60 MΩ
between primary and core		> 60 MΩ
Mains insulation		according to IEC 65, class 2, and VDE 0860

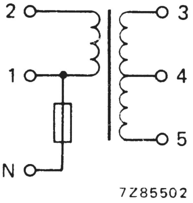


Fig. 3 Diagram.

TESTS

The mains transformer withstands the following tests:

Vibration	IEC 68-2-6, test Fc, procedure B4; 10-55-10 Hz, amplitude 0,35 mm, 3 x 30 min.
Bump	IEC 68-2-29, test Eb; 40g, 4000 bumps, 3 directions.
Dry heat	IEC 68-2-2, test Ba; 16 h, + 125 °C.
Damp heat, steady state	IEC 68-2-3, test Ca, 21 days, R.H. 95%.
Damp heat, accelerated	IEC 68-2-4, test D, + 55 °C, R.H. 95 to 100%.
Change of temperature	IEC 68-2-14, test Na; 5 cycles, T_A = –25 °C, T_B = + 125 °C.
Flammability	UL94, category V2.

DEGAUSSING COILS
for 20AX picture tubes
with mains isolation

APPLICATION

Two coils mounted on the top and bottom of the cone of the picture tube produce in conjunction with PTC thermistor 2322 662 98009 a decaying alternating field. The coils have to be connected in such a way that they operate magnetically in series, producing flux lines which flow from the top coil through the picture tube into the bottom coil or vice versa.

MECHANICAL DATA

The coils are completely sleeved with a flame-retardent foil; to guarantee mains isolation the coil ends are connected to a holder. For connecting the coils to the circuit a special plug has to be used.

Outlines

Dimensions in mm

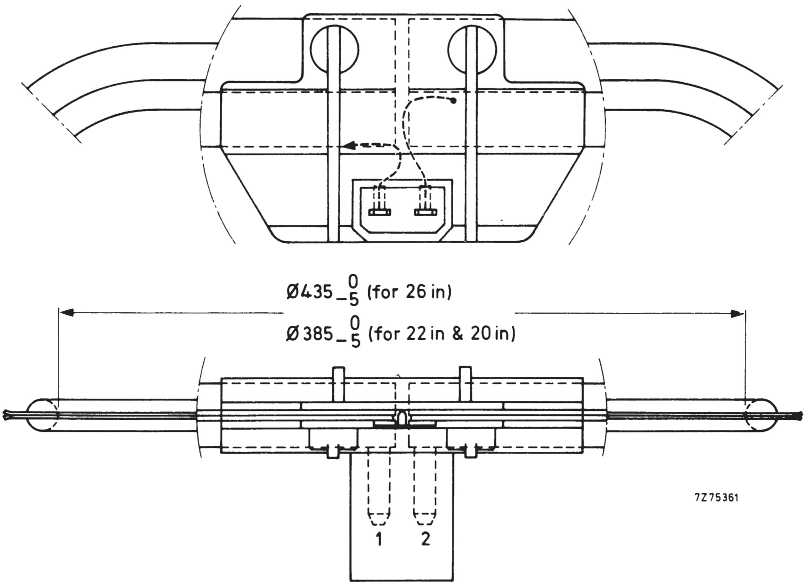

$\varnothing 435_{-5}^{\ 0}$ (for 26 in)
$\varnothing 385_{-5}^{\ 0}$ (for 22 in & 20 in)
7Z75361
1
2

Fig.1

Dimensions of plug
Housing 3122 128 70921
Receptacle 3122 128 70931

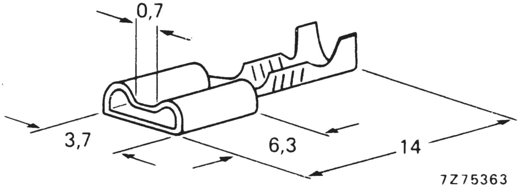
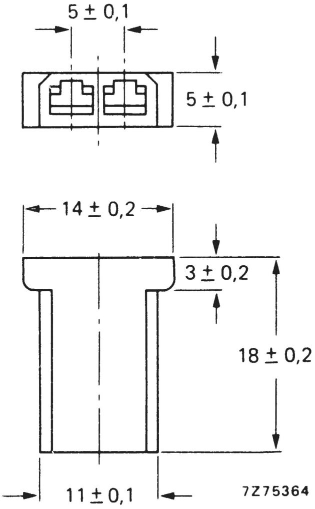

0,7
3,7
6,3
14
7Z75363

Fig.2


5 ± 0,1
5 ± 0,1
14 ± 0,2
3 ± 0,2
18 ± 0,2
11 ± 0,1
7Z75364

ELECTRICAL DATA

Coil resistance		
26 inch	catalogue no. 3122 138 75581	8,6 Ω ± 10%
22 and 20 inch	catalogue no. 3122 138 75941	11,5 Ω ± 10%
Number of turns		
26 inch		52
22 and 20 inch		49
Mains isolation		acc. to IEC 65
Maximum working temperature		70 °C

DEGAUSSING COILS

with double insulation

APPLICATION

For 26 in, 22 in and 20 in , 110° colour picture tubes. Two coils mounted on the top and bottom of the cone of the picture tube produce in conjunction with PTC thermistor 2322 662 98009 a decaying alternating field. The coils have to be connected in such a way that they operate magnetically in series, producing flux lines which flow from the top coil through the picture tube into the bottom coil or vice versa.

MECHANICAL DATA

The coils are completely double sleeved with a flame-retardent foil; to guarantee mains isolation the coil ends are connected to a holder. For connecting the coils to the circuit a special plug has to be used (see Figs 2 and 3).

Outlines

Dimensions in mm

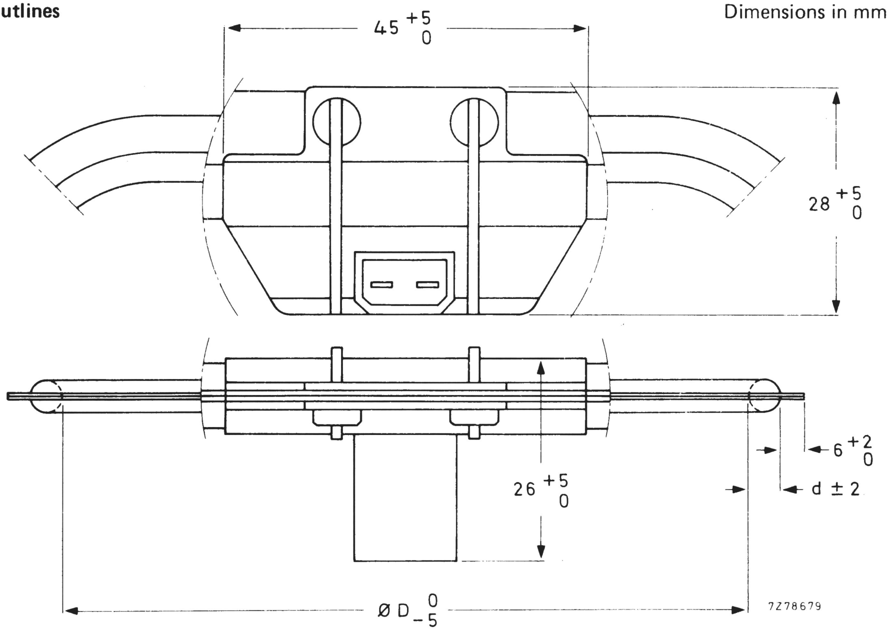


Fig. 1.

degaussing coil catalogue no.	D mm	d mm
3122 138 94350 for 26 in tube	435	8
3122 138 94380 for 22 in and 20 in tube	385	5

Dimensions of plug

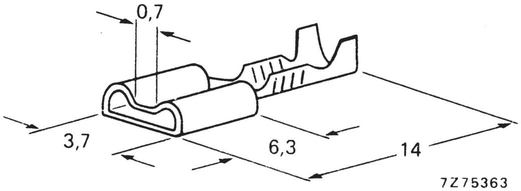

0,7
3,7
6,3
14
7Z75363

Fig. 2 Receptacle (3122 128 70931).

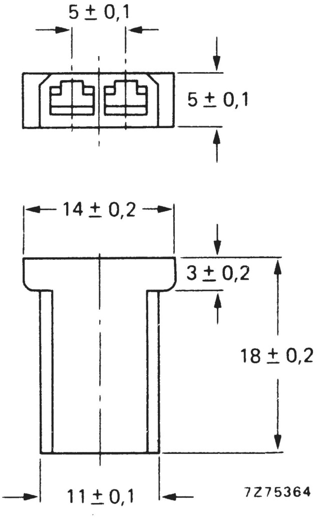

5 ± 0,1
5 ± 0,1
14 ± 0,2
3 ± 0,2
18 ± 0,2
11 ± 0,1
7Z75364

Fig. 3 Housing (3122 128 70921)
for two receptacles.

Insertion force	max.	50 N
Withdrawal force	min.	10 N

ELECTRICAL DATA

Coil resistance		
→ 26 inch type	(catalogue no. 3122 138 94350)	8,6 Ω ± 10%
22 and 20 inch type	(catalogue no. 3122 138 94380)	11,5 Ω ± 10%
Number of turns		
26 inch type		52
22 and 20 inch type		49
Safety		acc. to IEC 65.10 and UL1410
Maximum working temperature		70 °C

DEGAUSSING COIL

with single insulation

APPLICATION

For 20 inch 90° picture tubes. Two coils mounted on the top and bottom of the cone of the picture tube produce in conjunction with PTC thermistor 2322 662 98009 a decaying alternating field. The coils have to be connected in such a way that they operate magnetically in series, producing flux lines which flow from the top coil through the picture tube into the bottom coil or vice versa.

MECHANICAL DATA

The coils are completely sleeved with a flame-retardent foil; to guarantee isolation the coil ends are connected to a holder. For connecting the coils to the circuit a special plug has to be used (see Figs 2 and 3).

Outlines

Dimensions in mm

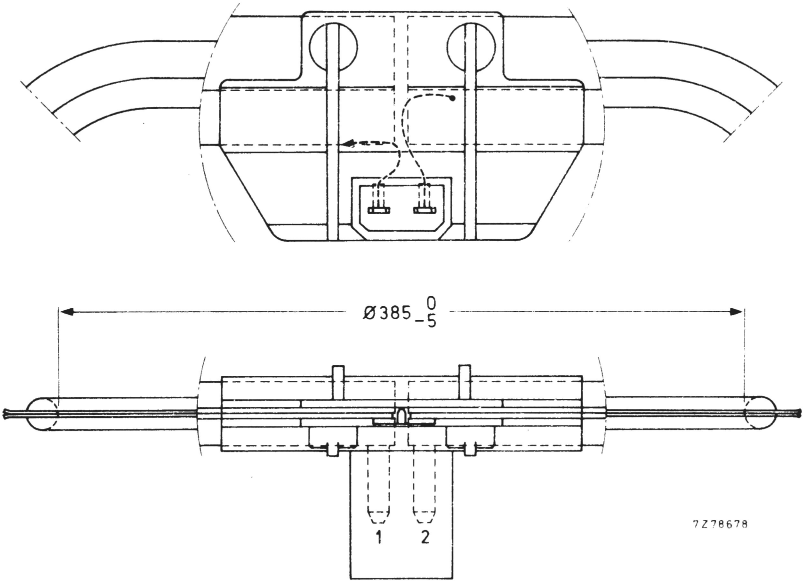


Fig. 1.

Dimensions of plug

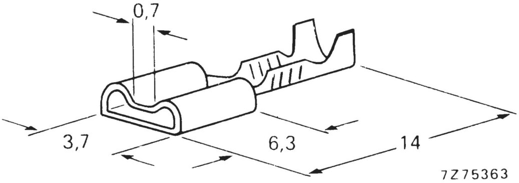

0,7
3,7
6,3
14
7Z75363

Fig. 2 Receptacle (3122 128 70931).

Insertion force	max.	50 N
Withdrawal force	min.	10 N

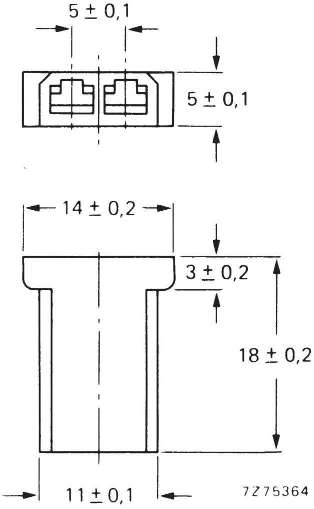

5 ± 0,1
5 ± 0,1
14 ± 0,2
3 ± 0,2
18 ± 0,2
11 ± 0,1
7Z75364

Fig. 3 Housing (3122 128 70921) for two receptacles.

ELECTRICAL DATA

Coil resistance	11 Ω ± 10%
Number of turns	60
Safety	acc. to IEC 65.10
Maximum working temperature	70 °C

DEGAUSSING COILS

- For 220/240 V mains voltage
- Single insulation

APPLICATION

For 14 in and 16 in, 90° colour picture tubes and high resolution data graphic display tubes. One coil asymmetrically mounted on the top and bottom of the cone of the tube, in conjunction with PTC thermistor 2322 662 98009, produces a decaying alternating field.

Degaussing coil 3122 138 99840 to be used with 14 in tubes, degaussing coil 3122 138 99850, to be used with 16 in tubes.

MECHANICAL DATA

Dimensions in mm

The coils of aluminium wire are completely sleeved with a flame-retardent foil; the coil ends are connected to pins in a holder. For connecting the coils to the circuit, plug 3122 124 17903* has to be used.

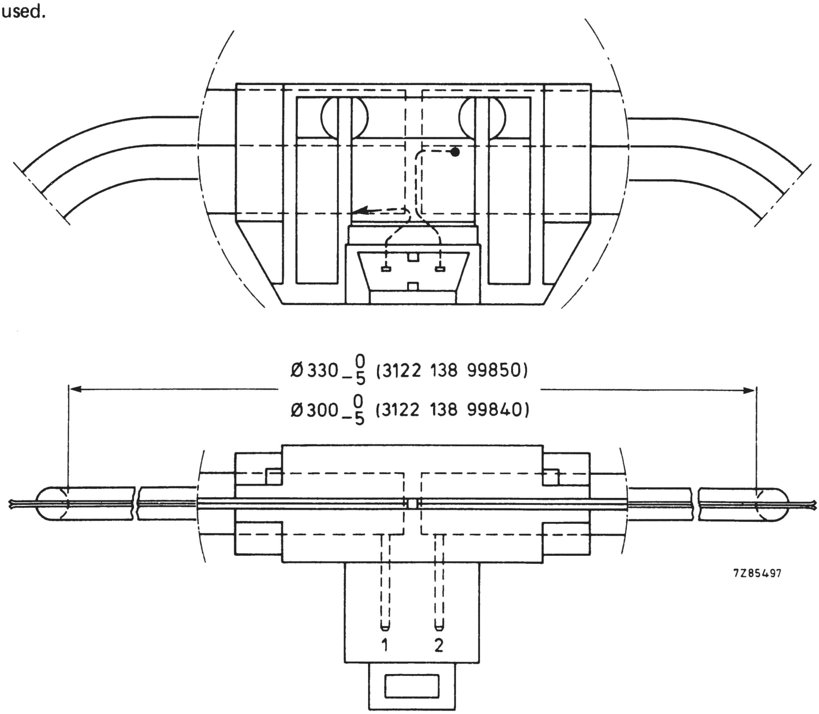

Ø330 $^{0}_{-5}$ (3122 138 99850)
Ø300 $^{0}_{-5}$ (3122 138 99840)
7Z85497
1
2

Fig. 1.

---

* To be ordered separately.

ELECTRICAL DATA

Coil resistance	
coil 3122 138 99840 (14 in)	22 Ω ± 10%
coil 3122 138 99850 (16 in)	23 Ω ± 10%
Number of turns	120
Test voltage (d.c.)	
between interconnected pins and insulation foil	6000 V
between interconnected pins and holder	6000 V
Maximum working temperature	70 ^oC

COMPONENTS FOR BLACK AND WHITE TELEVISION AND MONOCHROME DATA GRAPHIC DISPLAY

G

RECOMMENDED COMBINATIONS FOR BLACK AND WHITE TELEVISION

Picture tube		
screen diagonal	44 cm (17 in), 50 cm (20 in), 61 cm (24 in)	31 cm (12 in), 34 cm (14 in)
neck diameter	28 mm	20 mm
deflection angle	110°	110°
Deflection unit	AT1040/15	AT1074/00
Line output transformer	AT2048/12	AT2140
Linearity control unit	AT4042/14	
Line driver transformer	AT4043/87	

RECOMMENDED COMBINATIONS FOR MONOCHROME DATA GRAPHIC DISPLAY

	video (CCTV) and basic data display		half-page alpha-numeric data display			full-page alpha-numeric data display	
Picture tube screen diagonal neck diameter deflection angle	24 cm (9 in), 31 cm (12 in) 20 mm 90°		24 cm (9 in), 31 cm (12 in) 20 mm 90°	31 cm (12 in), 38 cm (15 in) 28,6 mm 110°		38 cm (15 in) 28,6 mm 110°	
Deflection unit	AT1074/01	AT1076/01 (12 in) AT1076/02 (9 in)	AT1071/03*	AT1038/40	AT1038/40	AT1039/00	AT1039/01
Line output transformer	AT2140/10	AT2140/16	AT2102/02	AT2102/04	AT2102/06	AT2076/51 AT2076/53	AT2076/54
Linearity control unit	AT4042/26	AT4042/46	AT4036	AT4042/42	AT4042/42		AT4042/42
Line driver transformer	AT4043/64		AT4043/64	AT4043/64	AT4043/64	AT4043/87	AT4043/87
D.C. shift transformer						AT4043/29	AT4043/29
Dynamic focus transformer					AT4043/67		

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* For correct fitting to the tube neck, a spacer, catalogue number 3122 134 07820, is required.

DEFLECTION UNIT

- For Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in), 38 cm (15 in)
neck diameter	28 mm
Deflection angle	110°
Line deflection current, edge to edge at 17 kV	4,56 A (p-p)
Inductance of line coils, parallel connected	700 μH
Field deflection current, edge to edge at 17 kV	1,13 A (p-p)
Resistance of field coils, parallel connected	7,6 Ω

APPLICATION

This deflection unit has been designed for use with 31 cm (12 in) and 38 cm (15 in) 110° monochrome monitor tubes in conjunction with:

line output transformer AT2102/04 or AT2102/06;
linearity control unit AT4042/42;
line driver transformer AT4043/59 or AT4043/64.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the monitor tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the field and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65-14 and UL492.3, category 94-V1.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the monitor tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the monitor tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA

Dimensions in mm

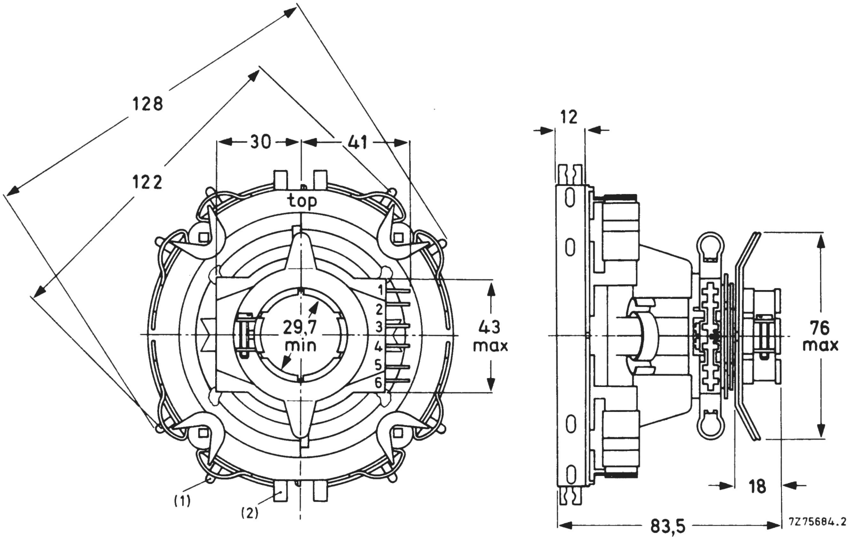


Fig. 1 Deflection unit AT1038/40.
(1) for plastic-bonded FXD magnets 3122 104 94120.
(2) for plastic-bonded FXD magnet rods 3122 104 90360.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a); terminals 3 and 4

Inductance	700 µH ± 4,5%
Resistance	1,1 Ω ± 8%

Field deflection coils, parallel or series connected (Fig. 2b); terminals 1 and 2 for parallel connected coils (terminals 1 and 6, and 2 and 5 to be interconnected); terminals 2 and 6 for series connected coils (terminals 1 and 5 to be interconnected)

Inductance (parallel connected coils)	14,1 mH ± 8%
Inductance (series connected coils)	56,4 mH ± 8%
Resistance (parallel connected coils)	7,6 Ω ± 8%
Resistance (series connected coils)	30,4 Ω ± 8%
Maximum d.c. voltage between line and field coils	2500 V
Maximum operating temperature	95 °C

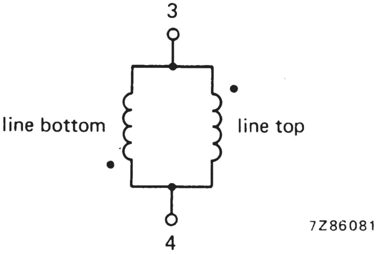

3
line bottom
line top
4
7Z86081

Fig. 2a Line coils.

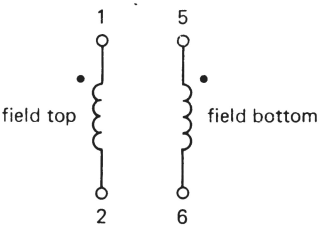

1
5
field top
field bottom
2
6

Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

The following characteristics are measured at an e.h.t. of 17 kV on a 38 cm (15 in) reference tube.

Sensitivity

Deflection current edge to edge	
in line direction	4,56 A (p-p)
in field direction	1,13 A (p-p)

Geometric distortion measured without correction magnets on a 38 cm (15 in) reference tube.

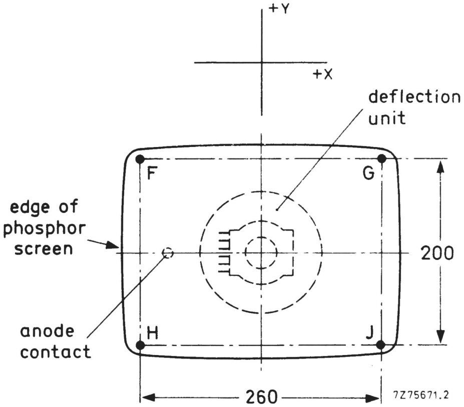

+Y
+X
deflection unit
F
G
H
J
edge of phosphor screen
anode contact
200
260
7Z75671.2

Fig. 3.

Fy : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$

Gy : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$

Jy : $+4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$

Hy : $+4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$

Fx : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$

Gx : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$

Jx : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$

Hx : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

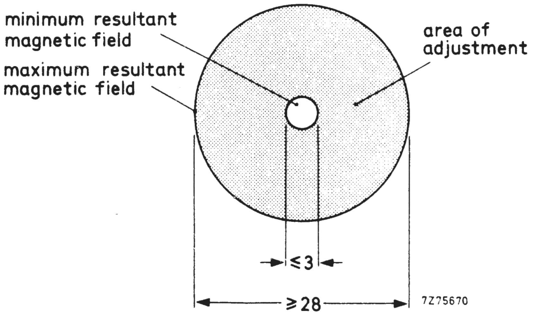

minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤3
≥28
7Z75670

Fig. 4.

For pin-cushion distortion

Pin-cushion distortion can be corrected by four Ferroxdure magnets with pole-shoe brackets, which have been mounted on the deflection unit. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal movement of these magnets. The field strength can be adjusted by rotation of these magnets.

→ To correct the top and bottom of the raster, two plastic-bonded Ferroxdure magnet rods* can be fitted (Fig. 1). To correct the corners of the raster, four plastic-bonded Ferroxdure magnets** can be fitted (Fig. 1).

---

* Available under catalogue number 3122 104 90360.
** Available under catalogue number 3122 104 94120.

DEFLECTION UNITS

- For Data Graphic Displays
- For use with high resolution 38 cm (15 in)/110° monochrome CRTs

QUICK REFERENCE DATA

	AT1039/00	AT1039/01
Diagonal of CRT	38 cm (15 in)	38 cm (15 in)
Neck diameter of CRT	max. 28,6 mm	max. 28,6 mm
Deflection angle	110°	110°
Line deflection current for full scan, at 17 kV	6,40 $A_{(p-p)}$	8,35 $A_{(p-p)}$
Inductance of line coils, parallel connected	228 μH	206 μH
Field deflection current for full scan, at 17 kV	1,35 $A_{(p-p)}$	1,02 $A_{(p-p)}$
Resistance of field coils, series connected	10,2 Ω	10,6 Ω

APPLICATION

These deflection units are for use with high resolution 38 cm (15 in)/110° monochrome CRTs. The AT1039/00 is for use in 'portrait' scan mode (longest axis of screen vertical) with line scan frequency up to 64 kHz. The AT1039/01 is for use in 'landscape' scan mode (shortest axis of screen vertical) with line scan frequency up to 32 kHz.

The units are used in conjunction with:

	AT1039/00	AT1039/01
Line output transformer	AT2076/51 or /53	AT2076/54
Linearity control unit	–	AT4042/42
Line driver transformer	AT4043/87	AT4043/87
D.C. shift transformer	AT4043/29	AT4043/29

DESCRIPTION

The saddle-shaped line and field deflection coils are surrounded by a Ferroxcube yoke ring so that the line and field deflection centres coincide. A special winding technique guarantees a precise magnetic field and a high reproducibility. Provisions are made for beam centring and raster distortion correction. The units meet the self-extinguishing requirements of CSA, IEC and UL.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube so that it touches the cone; the maximum push-on force on the tube is 30 N.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 to 0,9 Nm.

MECHANICAL DATA

Dimensions in mm

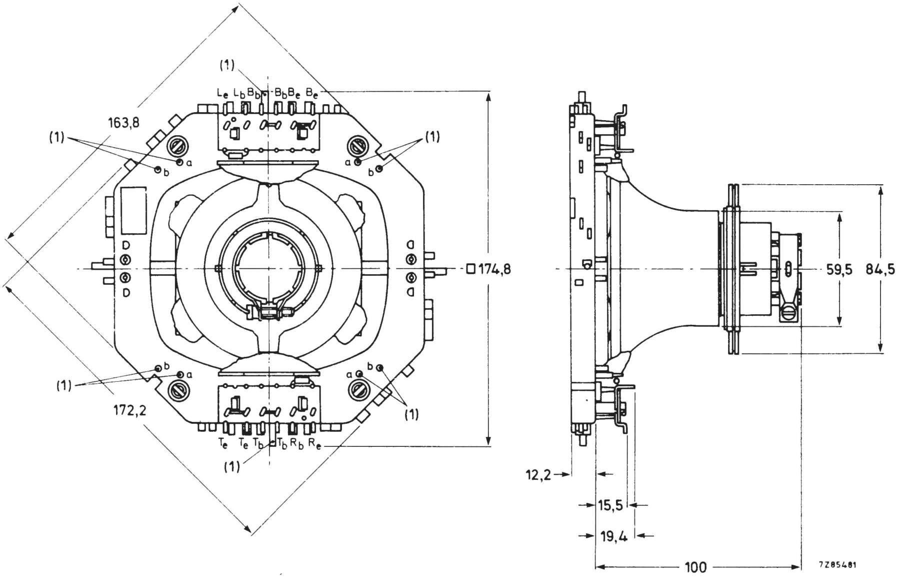

(1)
L_e L_b B_b B_b B_e B_e
163,8
(1)
a
b
(1)
a
b
D
D
a
a
□174,8
(1)
b
a
(1)
a
b
172,2
T_e T_e T_b T_b R_b R_e
(1)
(1)
59,5
84,5
12,2
15,5
19,4
100
7Z85481

Fig. 1 Deflection units AT1039/00 and AT1039/01.

(1) For fitting plastic-bonded FXD magnet rings, catalogue number 3122 134 92300, to obtain optimum raster performance; a to be used for AT1039/00, b for AT1039/01.

The unit has solder pins for connection. The pin numbering in Fig. 1 corresponds to that in Fig. 2.

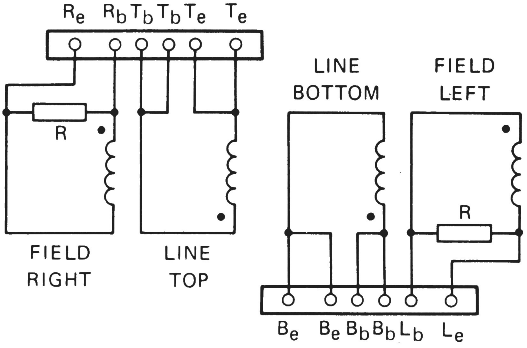
ELECTRICAL DATA

	AT1039/00		AT1039/01	
	parallel connected	series connected	parallel connected	series connected
Line deflection coils				
terminals	T_b (or B_b) and T_e or (B_e)*	T_b and B_e**	T_b (or B_b) and T_e (or B_e)*	T_b and B_e**
inductance	228 μH ± 4%	912 μH ± 4%	206 μH ± 4%	824 μH ± 4%
resistance	0,41 Ω ± 10%	1,64 Ω ± 10%	0,39 Ω ± 10%	1,56 Ω ± 10%
line deflection current edge to edge, at 17 kV	6,40 $A_{(p-p)}$	1,6 $A_{(p-p)}$	8,35 $A_{(p-p)}$	2,1 $A_{(p-p)}$
Field deflection coils				
terminals	R_b (or L_b) and R_e (or L_e)▲	R_e and L_b***	R_b (or L_b) and R_e (or L_e)▲	R_e and L_b***
inductance	2,30 mH ± 10%	9,18 mH ± 10%	2,43 mH ± 10%	9,72 mH ± 10%
resistance	2,55 Ω ± 8%	10,2 Ω ± 8%	2,7 Ω ± 8%	10,6 Ω ± 8%
field deflection current, edge to edge, at 17 kV	5,4 $A_{(p-p)}$	1,35 $A_{(p-p)}$ ± 5%	4,1 $A_{(p-p)}$	1,02 $A_{(p-p)}$ ± 5%

Maximum permissible d.c. voltage between line and field coils	2500 V
Maximum permissible d.c. voltage between field coil and yoke ring	300 V
Coupling between line and field coils, at 1 V, 500 Hz	⩽ 1/300

Note: The values apply at an ambient temperature of 25 °C

Fig. 2 Diagram of line and field coils; R = 270 Ω. The beginning of the windings is indicated with ●.


R_e R_b T_b T_b T_e T_e
R
FIELD RIGHT
LINE TOP
LINE BOTTOM
FIELD LEFT
R
B_e B_e B_b B_b L_b L_e
7Z85485

---

* Terminals T_b and T_e to be connected to B_b and B_e respectively.
** Terminals T_e and B_b to be interconnected.
***Terminals R_b and L_e to be interconnected.
▲ Terminals R_b and R_e to be connected to L_b and L_e respectively.

Geometric distortion, measured without centring magnets.

Operating conditions of the CRT: $V_a = 17$ kV, $V_{g2} = 700$ V, $I_a = 50\ \mu$A; horizontal and vertical dynamic focusing applied.

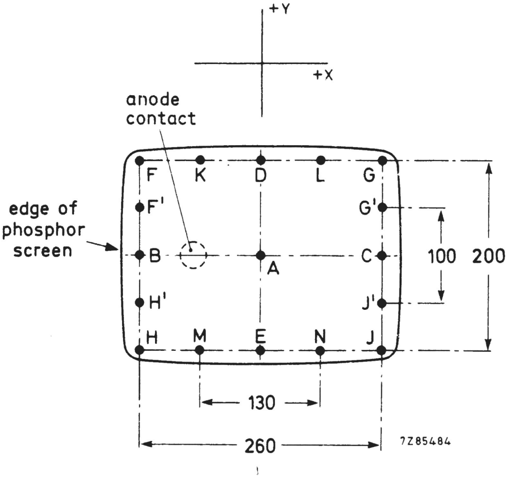

+Y
+X
anode contact
edge of phosphor screen
F
K
D
L
G
F'
G'
B
A
C
H'
J'
H
M
E
N
J
100
200
130
260
7Z85484

Fig. 4 AT1039/01.

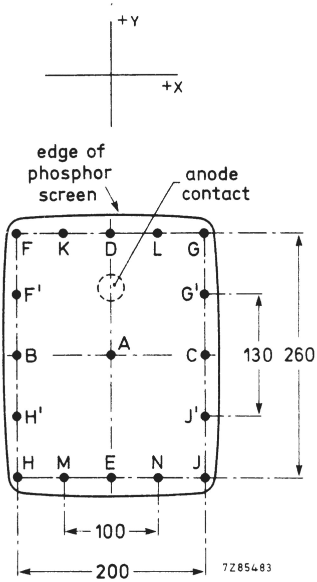

+Y
+X
edge of phosphor screen
anode contact
F
K
D
L
G
F'
G'
B
A
C
H'
J'
H
M
E
N
J
130
260
100
200
7Z85483

Fig. 3 AT1039/00.

F_y : $+0{,}5\ ^{+2{,}0}_{-1{,}0}$

G_y : $+0{,}5\ ^{+2{,}0}_{-1{,}0}$

J_y : $-0{,}5\ ^{-2{,}0}_{+1{,}0}$

H_y : $-0{,}5\ ^{-2{,}0}_{+1{,}0}$

K_y : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

L_y : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

N_y : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

M_y : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

F_y' : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

G_y' : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

J_y' : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

H_y' : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

F_x : $-0{,}5\ ^{-2{,}0}_{+1{,}0}$

G_x : $+0{,}5\ ^{+2{,}0}_{-1{,}0}$

J_x : $+0{,}5\ ^{+2{,}0}_{-1{,}0}$

H_x : $-0{,}5\ ^{-2{,}0}_{+1{,}0}$

K_x : $-0{,}25\ ^{-1{,}25}_{+0{,}75}$

L_x : $+0{,}25\ ^{+1{,}25}_{-0{,}75}$

N_x : $+0{,}25\ ^{+1{,}25}_{-0{,}75}$

M_x : $-0{,}25\ ^{-1{,}25}_{+0{,}75}$

F_x' : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

G_x' : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

J_x' : $+0{,}25\ ^{+1{,}0}_{-0{,}5}$

H_x' : $-0{,}25\ ^{-1{,}0}_{+0{,}5}$

ENVIRONMENTAL DATA

Maximum operating temperature (average copper temperature)	95 °C
Maximum permissible temperature rise (ΔT) as a result of coil losses	35 °C
Storage temperature range	−25 to + 95 °C
Flame retarding	according to UL492.3
Flammability	according to UL94, category V1

ENVIRONMENTAL TESTS

The deflection units withstand the following tests:

Vibration	IEC 68-2-6; test Fc, procedure B4; 10-55-10 Hz, amplitude 0,35 mm, 3 x 30 min.
Bump	IEC 68-2-29, test Eb; 25 g, 1000 bumps, 6 directions.
Shock	IEC 68-2-27, test Ea; 11 ms, half-sine pulse shape, 35 g, 3 x 6 directions.
Cold	IEC 68-2-1, test Ab; 96 h, −25 °C.
Dry heat	IEC 68-2-2, test Bb; 96 h, + 95 °C.
Cyclic damp heat	IEC 68-2-30, test Db; 21 cycles, + 40 °C.
Damp heat, steady state	IEC 68-2-3, test Ca, 21 days.
Change of temperature	IEC 68-2-14, test Nb; 5 cycles of 2 h at −25 °C and 2 h at + 95 °C, duration of one cycle 5 h.

CORRECTION FACILITIES

For centring

After adjusting the deflection current linearity, the eccentricity of the tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The required torque on the magnets is 35 to 250 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

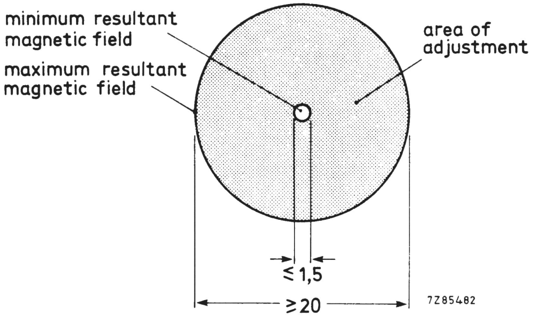

minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤ 1,5
≥ 20
7Z85482

Fig. 5.

For raster correction

The units have provisions for mounting magnet rings* to correct the top, bottom, sides and corners of the raster. Use of the magnet rings should be limited, because the spot performance of the units may be deteriorated.

PACKING

The deflection units are packed in boxes of 16.

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* Plastic-bonded Ferroxdure magnet rings are available under catalogue number 3122 134 92300.

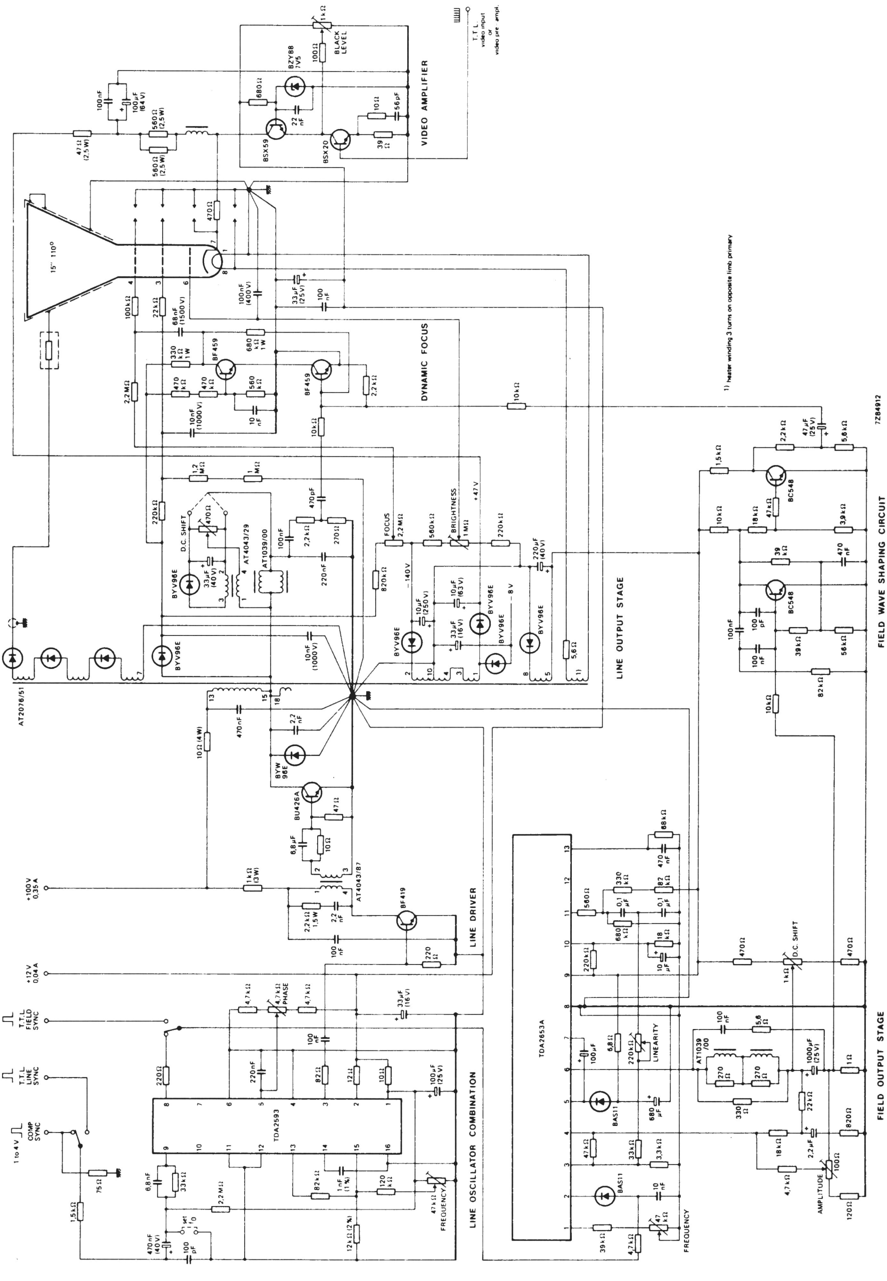
VIDEO AMPLIFIER
T.T.L. video input or video pre ampl.
BLACK LEVEL
BZY88 7V5
BSX59
BSX20
15" 110°
DYNAMIC FOCUS
BF459
FOCUS 2,2 MΩ
BRIGHTNESS 1 MΩ
D.C. SHIFT
AT4043/29
AT1039/00
BYV96E
+47 V
−140 V
−8 V
LINE OUTPUT STAGE
AT2076/51
BYW 96E
BU426A
AT4043/87
BF419
LINE DRIVER
+100 V 0,35 A
+12 V 0,04 A
T.T.L. FIELD SYNC
T.T.L. LINE SYNC
COMP SYNC 1 to 4 V
PHASE
TDA2593
FREQUENCY
LINE OSCILLATOR COMBINATION
TDA2653A
BAS11
LINEARITY
AT1039 /00
AMPLITUDE
D.C. SHIFT
FIELD OUTPUT STAGE
BC548
FIELD WAVE SHAPING CIRCUIT
1) heater winding 3 turns on opposite limb primary
7Z84912

Fig. 6 Application diagram; AT1039/00 used in ‘portrait’ scan mode, line scan frequency 64 kHz.

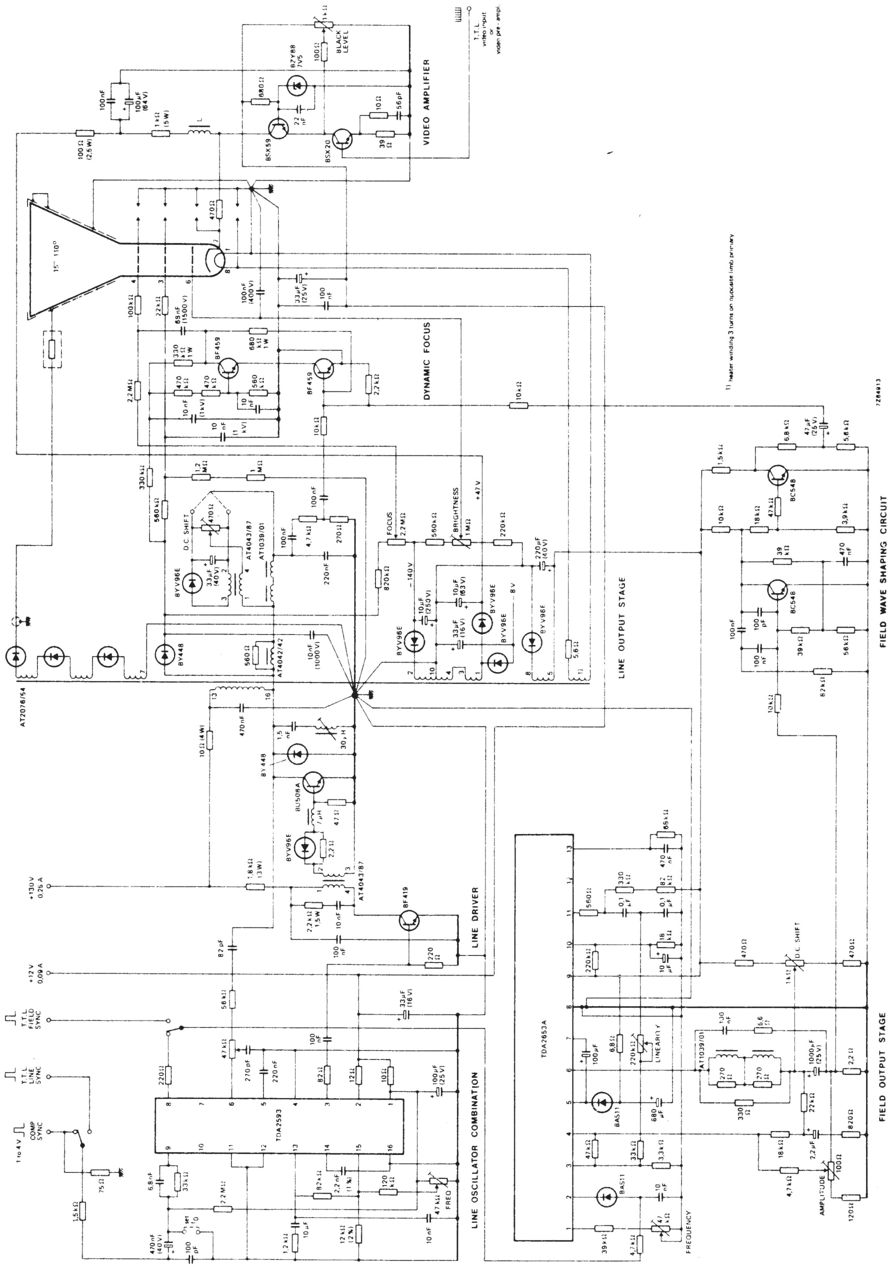
VIDEO AMPLIFIER
T.T.L. video input or video pre-ampl.
BLACK LEVEL
BZY88 7V5
BSX59
BSX20
15" 110°
DYNAMIC FOCUS
BF459
1) heater winding 3 turns on opposite limb primary
7Z84913
D.C. SHIFT
AT4043/87
AT1039/01
BYV96E
FOCUS
BRIGHTNESS
+47 V
−140 V
−8 V
LINE OUTPUT STAGE
BY448
AT4042/42
AT2076/54
BU508A
AT4043/87
BF419
LINE DRIVER
+130 V 0,25 A
+12 V 0,09 A
T.T.L. FIELD SYNC
T.T.L. LINE SYNC
COMP SYNC
1 to 4 V
TDA2593
FREQ
LINE OSCILLATOR COMBINATION
TDA2653A
BAS11
LINEARITY
FREQUENCY
AT1039/01
D.C. SHIFT
AMPLITUDE
BC548
FIELD WAVE SHAPING CIRCUIT
FIELD OUTPUT STAGE

Fig. 7 Application diagram; AT1039/01 used in 'landscape' scan mode, line scan frequency 32 kHz.

DEFLECTION UNIT

QUICK REFERENCE DATA	
Picture tube, diagonal	43 cm (17 in), 48 cm (19 in), 51 cm (20 in), 58 cm (23 in) and 61 cm (24 in)
neck diameter	28 mm
Deflection angle	110^{o}
Line deflection current, edge to edge at 18 kV	2,3 A (p-p)
Inductance of line coils, parallel connected	3,32 mH
Field deflection current, edge to edge at 18 kV	1,1 A (p-p)
Resistance of field coils, parallel connected	7,5 Ω

APPLICATION

This deflection unit has been designed for use with a 110^{o} black and white picture tube in conjunction with:
- line output transformer AT2048/12; ←
- linearity control unit AT4042/02 or AT4042/14;
- line output transistor BU205.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.
The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide.

The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

For centring and pin-cushion distortion see under "Correction facilities".

MECHANICAL DATA

Dimensions (in mm) and terminals

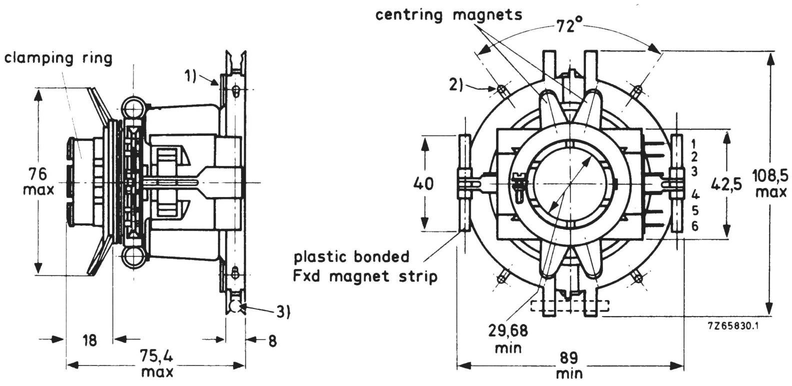
clamping ring
1)
76 max
18
75,4 max
8
3)
centring magnets
72°
2)
40
1
2
3
4
5
6
42,5
108,5 max
plastic bonded Fxd magnet strip
29,68 min
89 min
7Z65830.1

Fig. 1. 1) For fitting plastic bonded Fxd magnet strips, catalogue number 3122 137 10160.

2) For fitting plastic bonded Fxd magnets, catalogue number 3122 104 94120.

3) For fitting plastic bonded Fxd magnets, catalogue number 3122 104 90360.

The unit is provided with soldering pins for connection. The pin numbering in the figure corresponds to that in the connection diagrams (Figs. 2 and 3).

Weight	300 g approximately

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2) terminals 3 and 4	
Inductance	3,32 mH ± 5%
Resistance	6,1 Ω ± 10%
Field deflection coils, parallel connected (Fig. 3) terminals 1 and 6	
Inductance	17 mH ± 10%
Resistance	7,5 Ω ± 8,5%
Maximum peak voltage between terminals of line and field coils (50 Hz)	2500 V
Maximum operating temperature	105 °C

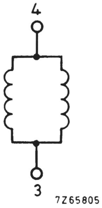

Fig. 2 Line coils

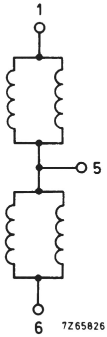

Fig. 3 Field coils

The following characteristics are measured at an e.h.t. of 18 kV on a 61 cm (24 in) reference picture tube.

Sensitivity

Deflection current edge to edge [1]	
in line direction	2,3 A p-p ± 7%
in field direction	1,1 A p-p + 3,5%

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[1] Minimum useful screen dimensions: 481 mm x 375 mm.

Geometric distortion (measured without correction magnets)

Barrel distortion in the corners	max. 1 mm
Pin cushion distortion	the edges of the raster fall within the two rectangles shown in Fig. 4.
Trapezium distortion	the edges of the raster fall within the two rectangles shown in Fig. 5.

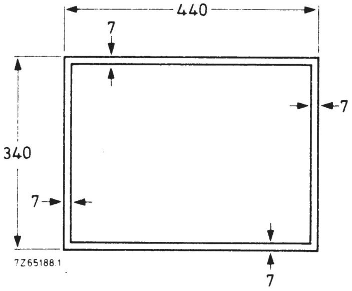
440
7
7
340
7
7
7Z65188.1

Fig. 4

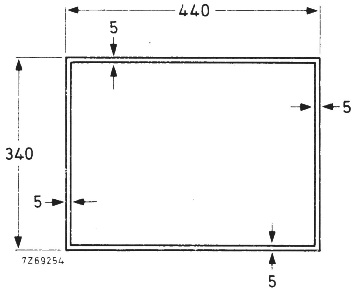
440
5
5
340
5
5
7Z69254

Fig. 5

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded ferroxdure. These magnets are magnetised diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.
These centring magnets can not be used for compensating the effects of non-linearity or of phase differences between the synchronisation and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

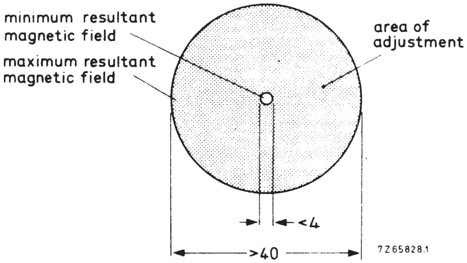
minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
<4
>40
7Z65828.1

Fig. 6

For pin-cushion distortion

Pin-cushion distortion can be corrected by plastic bonded ferroxdure magnet strips, which have been mounted on the deflection unit brackets [1]. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal rotation of these magnets.

Notes

To correct the corners of the raster plastic bonded ferroxdure magnets can be fitted to the deflection unit, see Fig. 1.
These magnets can be supplied on request; please quote the 12-digit catalogue number (see Fig. 1) for ordering.

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[1] Magnet strips are also available separately under catalogue number 3122 137 10160.

DEFLECTION UNIT

QUICK REFERENCE DATA

Monitor tube	
diagonal	24 cm (9 in), 31 cm (12 in)
neck diameter	20 mm*, 28 mm
Deflection angle	90°
Line deflection current, edge to edge at 16 kV	9,3 A (p-p)
Inductance of line coils, parallel connected	93 μH
Field deflection current, edge to edge at 16 kV	0,91 A (p-p)
Resistance of field coils, parallel connected	6,75 Ω

APPLICATION

This deflection unit has been designed for use with 24 cm (9 in) or 31 cm (12 in) 90° monochrome monitor tubes in conjunction with:

line output transformer AT2102/02;
linearity control unit AT4036;
line driver transformer AT4043/56.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the monitor tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the monitor tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the monitor tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

Note: Use of the deflection unit with a monitor tube with a neck diameter of 20 mm requires the use of a packing piece, catalogue number 3122 134 07820.

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* Packing piece required, see Mounting.

MECHANICAL DATA

Dimensions in mm

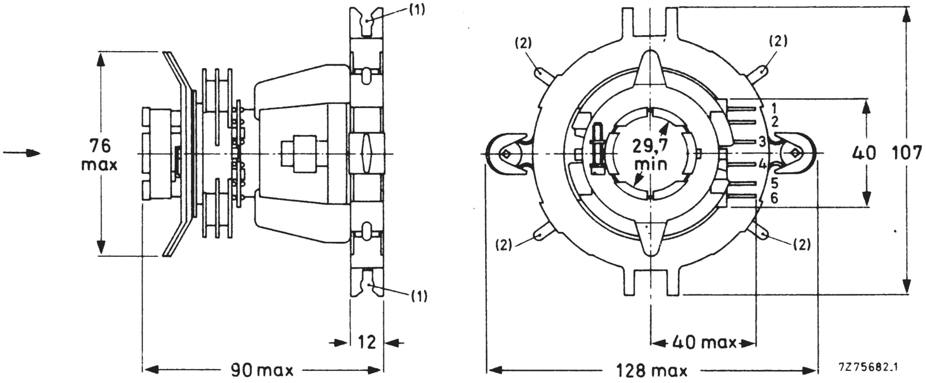

Fig. 1 Deflection unit AT1071/03. Facilities for fitting correction magnets:
(1) for plastic-bonded FXD magnet rods, catalogue number 3122 104 90360;
(2) for plastic-bonded FXD magnets, catalogue number 3122 104 94120.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagram (Figs 2a and 2b).

ELECTRICAL DATA

Line deflection coils, parallel connected (Fig. 2a); terminals 3 and 4	
Inductance	93 μH
Resistance	0,15 Ω
Field deflection coils, parallel or series connected (Fig. 2b); terminals 1 and 2 for parallel connected coils (terminals 1 and 6, and 2 and 5 to be interconnected); terminals 2 and 6 for series connected coils (terminals 1 and 5 to be interconnected)	
Inductance (parallel connected coils)	14 mH
Inductance (series connected coils)	56 mH
Resistance (parallel connected coils)	6,75 Ω
Resistance (series connected coils)	27 Ω
Maximum d.c. voltage between terminals of line and field coils	2000 V
Maximum operating temperature	95 °C

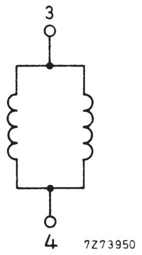

Fig. 2a Line coils.

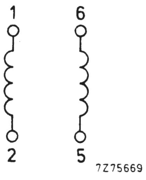
1
6
2
5
7Z75669

Fig. 2b Field coils.

The following characteristics are measured at an e.h.t. of 16 kV on a 24 cm (9 in) reference tube.

Sensitivity

Deflection current edge to edge

in line direction	9,3 A (p-p)
in field direction	0,91 A (p-p)

Geometric distortion measured without correction magnets on a 24 cm (9 in) reference tube.

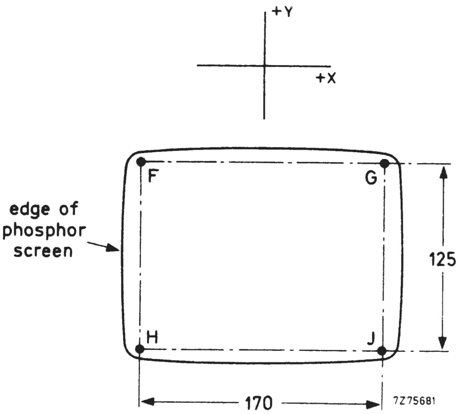
+Y
+X
F
G
H
J
edge of phosphor screen
125
170
7Z75681

Fig. 3.

Fy	+ 1,75	+ 1,25 −1,25	Fx	−1,25	−1,25 + 1,25
Gy	+ 1,75	+ 1,25 −1,25	Gx	+ 1,25	+ 1,25 −1,25
Jy	−1,75	−1,25 + 1,25	Jx	+ 1,25	+ 1,25 −1,25
Hy	−1,75	−1,25 + 1,25	Hx	−1,25	−1,25 + 1,25

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

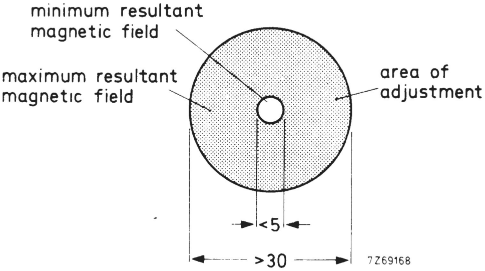
minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
<5
>30
7Z69168

Fig. 4.

For pin-cushion distortion

Pin-cushion distortion can be corrected by two Ferroxdure magnets with pole-shoe brackets, which have been mounted on the deflection unit. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal movement of these magnets. The field strength can be adjusted by rotation of these magnets. To correct the top and bottom of the raster, two plastic-bonded Ferroxdure magnet rods* can be fitted (Fig. 1). To correct the corners of the raster, four plastic-bonded Ferroxdure magnets** (Fig. 1) can be fitted.

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* Available under catalogue number 3122 104 90360.

** Available under catalogue number 3122 104 94120.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube		
diagonal	31 cm (12 in) 34 cm (14 in)	24 cm (9 in) 31 cm (12 in)
neck diameter	max. 20,9 mm	max. 20,9 mm
Deflection angle	110°	90°
Line deflection current for full scan, at 11 kV	5,02 A (p-p)	4,05 A (p-p)
Inductance of line coils, parallel connected	255 µH	
Field deflection current for full scan, at 11 kV	1,1 A (p-p)	0,91 A (p-p)
Resistance of field coils, parallel connected	2,7 Ω	

APPLICATION

The deflection unit has been designed for use with 31 cm (12 in) or 34 cm (14 in) 110° black and white picture tubes, or 24 cm (9 in) or 31 cm (12 in) 90° monochrome monitor tubes. The unit is used in conjunction with:

- line output transformer AT2140/10 or AT2140;
- linearity control unit AT4042/39;
- line driver transformer AT4043/56.

DESCRIPTION

The saddle shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA Dimensions in mm

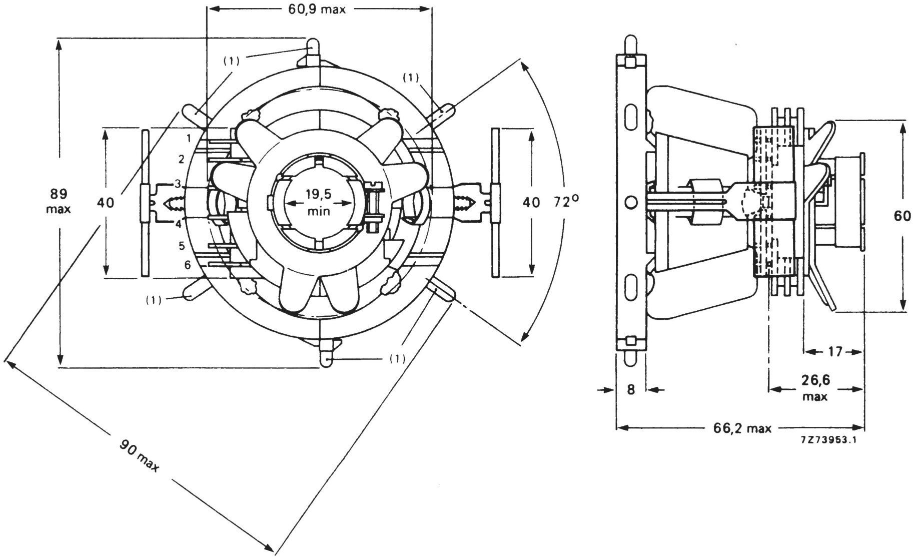

Fig. 1 Deflection unit AT1074. Facilities for fitting correction magnets:

(1) for plastic-bonded FXD magnets, catalogue number 3122 104 94120.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagrams (Fig. 2).

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a) terminals 3 and 4	
Inductance	255 μH ± 5%
Resistance	0,56 Ω
L/R	455 μH/Ω ± 8%
Field deflection coils, parallel connected (Fig. 2b) terminals 1 and 6	
Inductance	7,7 mH ± 8%
Resistance	2,7 Ω
L/R	2,87 mH/Ω ± 10%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature	95 °C

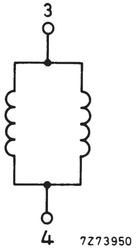

Fig. 2a Line coils.

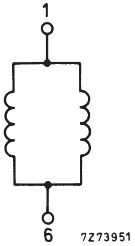

Fig. 2b Field coils.

The following characteristics are measured at an e.h.t. of 11 kV on a 31 cm (12 in) reference picture tube.

Sensitivity

Deflection current edge to edge	110°	90°
in line direction	5,02 A (p-p)	4,05 A (p-p)
in field direction	1,1 A (p-p)	0,91 A (p-p)

Geometric distortion measured without correction magnets, on a 31 cm (12 in) reference picture tube.

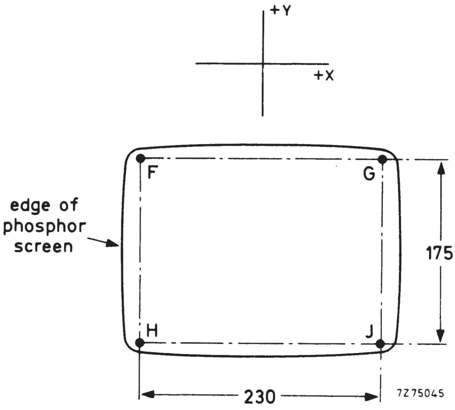
+Y
+X
F
G
H
J
edge of phosphor screen
175
230
7Z75045

Fig. 3.

Fy : 0^{+4}_{-2}

Gy : 0^{+4}_{-2}

Jy : 0^{-4}_{+2}

Hy : 0^{-4}_{+2}

Fx : 0^{-4}_{+2}

Gx : 0^{+4}_{-2}

Jx : 0^{+4}_{-2}

Hx : 0^{-4}_{+2}

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

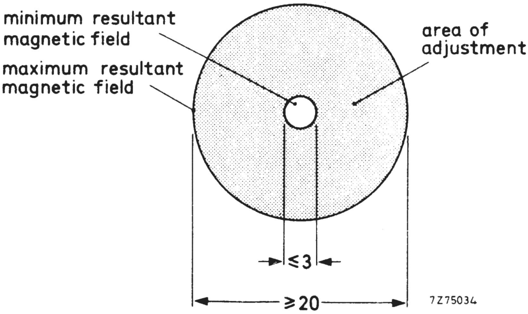
minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤3
≥20
7Z75034

Fig. 4.

For geometric distortion

The unit has provisions for fitting magnets* to correct the raster corners, see Fig. 1.

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* Plastic-bonded Ferroxdure magnets are available on request (catalogue number 3122 104 94120).

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube		
diagonal	31 cm (12 in) 34 cm (14 in)	24 cm (9 in) 31 cm (12 in)
neck diameter	max. 20,9 mm	max. 20,9 mm
Deflection angle	110°	90°
Line deflection current for full scan, at 11 kV	5,27 A (p-p)	4,25 A (p-p)
Inductance of line coils, parallel connected	255 µH	
Field deflection current for full scan, at 11 kV	0,577 A (p-p)	0,477 A (p-p)
Resistance of field coils, series connected	10,8 Ω	

APPLICATION

The deflection unit has been designed for use with 31 cm (12 in) or 34 cm (14 in) 110° black and white picture tubes, or 24 cm (9 in) or 31 cm (12 in) 90° monochrome monitor tubes. The unit is used in conjunction with:

- line output transformer AT2140/10 or AT2140;
- linearity control unit AT4042/26;
- line driver transformer AT4043/56.

DESCRIPTION

The saddle shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA

Dimensions in mm

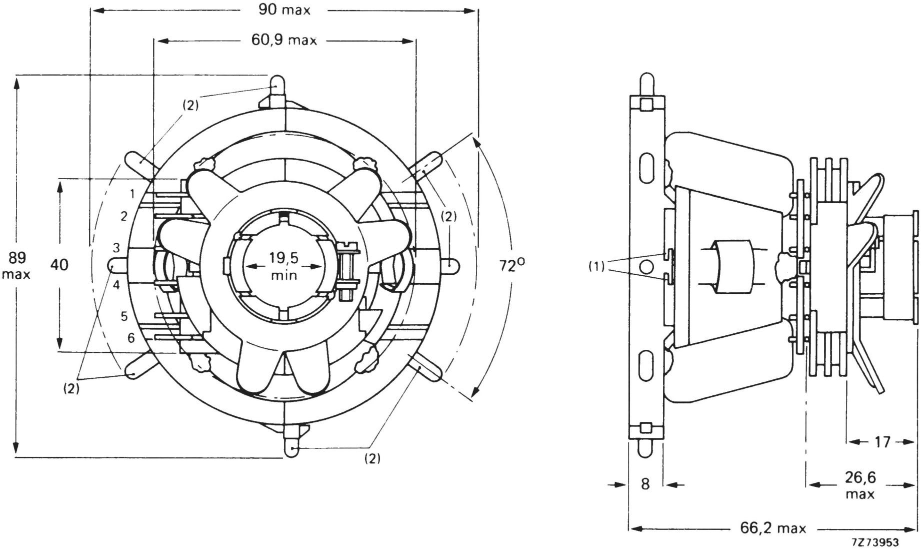

Fig. 1 Deflection unit AT1074/01. Facilities for fitting correction magnets:

(1) for bracket with plastic-bonded FXD magnet strip, catalogue number 3122 137 10160;

(2) For plastic-bonded FXD magnets, catalogue number 3122 104 94120.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagrams (Fig. 2).

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a) terminals 3 and 4	
Inductance	255 μH ± 5%
Resistance	0,56 Ω
L/R	455 μH/Ω ± 8%
Field deflection coils, series connected (Fig. 2b) terminals 1 and 6	
Inductance	28,96 mH ± 8%
Resistance	10,8 Ω
L/R	2,7 mH/Ω ± 10%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature	95 °C

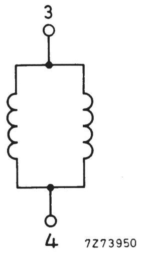

Fig. 2a Line coils.

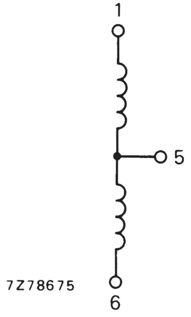
1
5
6
7Z78675

Fig. 2b Field coils.

The following characteristics are measured at an e.h.t. of 11 kV on a 31 cm (12 in) reference picture tube.

Sensitivity

Deflection current edge to edge	110°	90°
in line direction	5,27 A (p-p)	4,25 A (p-p)
in field direction	0,577 A (p-p)	0,477 A (p-p)

Geometric distortion measured without correction magnets, on a 31 cm (12 in) reference picture tube.

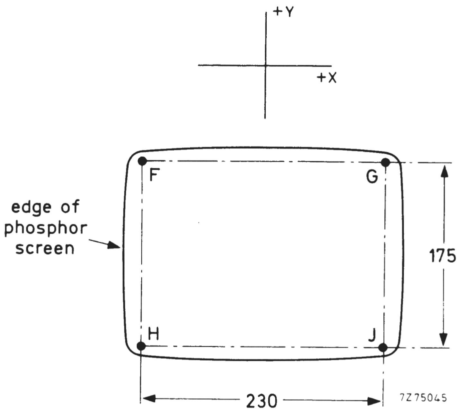
+Y
+X
F
G
H
J
edge of phosphor screen
175
230
7Z75045

Fig. 3.

Fy : 0^{+4}_{-2}

Gy : 0^{+4}_{-2}

Jy : 0^{-4}_{+2}

Hy : 0^{-4}_{+2}

Fx : 0^{-4}_{+2}

Gx : 0^{+4}_{-2}

Jx : 0^{+4}_{-2}

Hx : 0^{-4}_{+2}

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

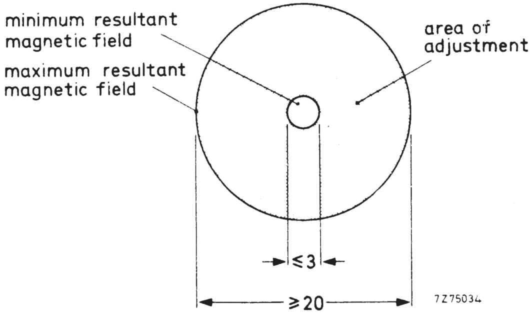
minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤3
≥20
7Z75034

Fig. 4.

For geometric distortion

The unit has provisions for mounting brackets for magnet strips* to correct pin-cushion distortion and for magnets** to correct the raster corners, see Fig. 1.

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* Plastic-bonded Ferroxdure magnet strips (with bracket) are available on request (catalogue number 3122 137 10160).

** Plastic-bonded Ferroxdure magnets are available on request (catalogue number 3122 104 94120).

DEFLECTION UNITS

- For Data Graphic Displays and monochrome TV

QUICK REFERENCE DATA

	AT1076/01	AT1076/02
Picture tube		
diagonal	31 cm (12 in)	24 cm (9 in)
neck diameter	max. 20,9 mm	max. 20,9 mm
Deflection angle	90°	
Line deflection current for full scan, at 10 kV	2,6 A(p-p)	2,72 A(p-p)
Inductance of line coils, series connected	470 μH	
Field deflection current for full scan, at 10 kV	0,22 A(p-p)	0,24 A(p-p)
Resistance of field coils, series connected	40 Ω	

APPLICATION

The deflection units AT1076/01 and AT1076/02 are for 31 cm (12 in) and 24 cm (9 in) respectively 90° monochrome monitor tubes. The units are used in conjunction with:
- line output transformer AT2140/16 (e.h.t. cable, length 260 mm, included);
- linearity corrector AT4042/46.

DESCRIPTION

The deflection units are of the hybrid type, with saddle wound line coils and toroidal wound field coils. The line coils and the field coils are series connected. The units have a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 to 0,9 Nm.

MECHANICAL DATA

Dimensions in mm

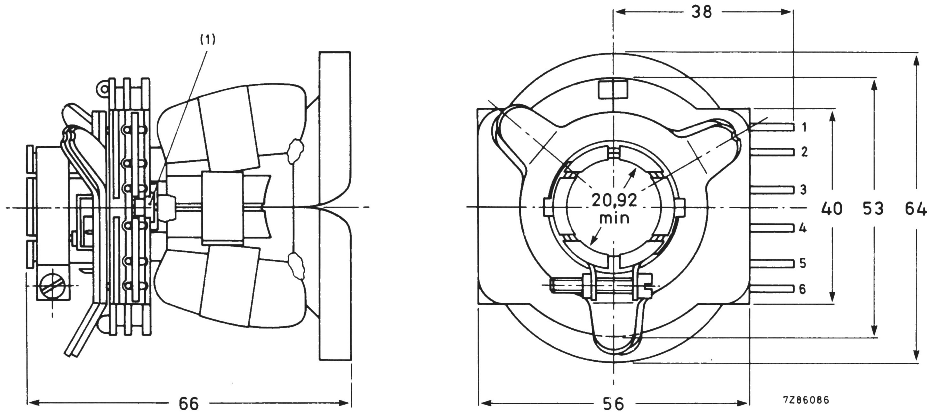


Fig. 1 Deflection units AT1076/01 and AT1076/02.

(1) for bracket with plastic-bonded FXD magnet strip, catalogue number 3122 137 60990.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 ^{o}C.

<table>
<tr><th></th><th>AT1076/01</th><th>AT1076/02</th></tr>
<tr><td>Line deflection coils, series connected (Fig. 2), terminals 3 and 6.</td><td></td><td></td></tr>
<tr><td>Inductance</td><td colspan="2">470 μH ± 3,5%</td></tr>
<tr><td>Resistance</td><td colspan="2">0,94 Ω</td></tr>
<tr><td>L/R</td><td colspan="2">4,99 μH/Ω ± 6%</td></tr>
<tr><td>Line deflection current, edge to edge, at 10 kV</td><td>2,6 A(p-p) ± 10%</td><td>2,72 A(p-p) ± 10%</td></tr>
<tr><td>Field deflection coils, series connected (Fig. 2) terminals 1 and 5</td><td></td><td></td></tr>
<tr><td>Inductance</td><td colspan="2">72 mH ± 8%</td></tr>
<tr><td>Resistance</td><td colspan="2">40 Ω</td></tr>
<tr><td>L/R</td><td colspan="2">1,82 mH/Ω ± 8%</td></tr>
<tr><td>Field deflection current, edge to edge, at 10 kV</td><td>0,22 A(p-p) ± 10%</td><td>0,235 A(p-p) ± 10%</td></tr>
</table>

Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

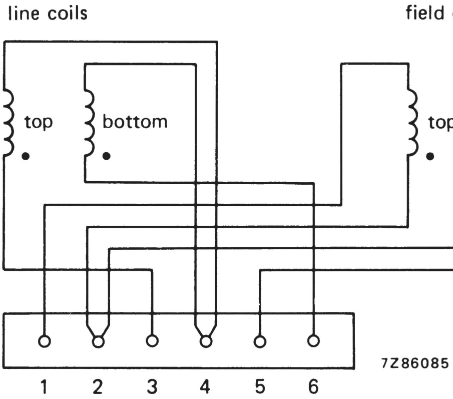

line coils
field coils
top
bottom
top
bottom
1
2
3
4
5
6
7Z86085

Fig. 2 Diagram of line and field coils. The beginning of the windings is indicated with ●.

Geometric distortion measured without centring magnets.

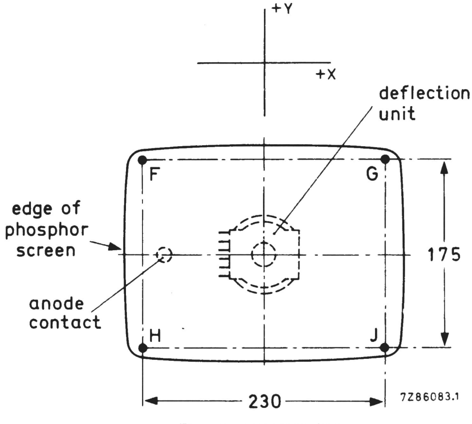

+Y
+X
deflection unit
F
G
edge of phosphor screen
175
anode contact
H
J
230
7Z86083.1

Fig. 3 AT1076/01.

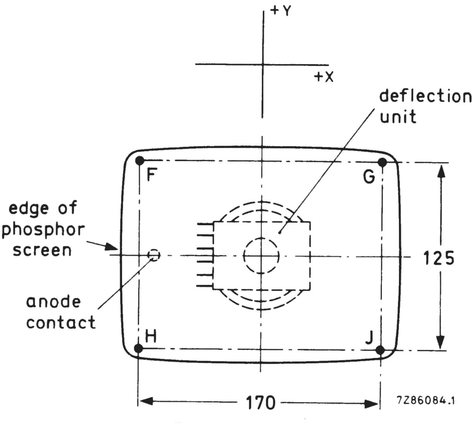

+Y
+X
deflection unit
F
G
edge of phosphor screen
125
anode contact
H
J
170
7Z86084.1

Fig. 4 AT1076/02.

$Fy : 0^{+3}_{-3}$	$Fx : 0^{-3}_{+3}$	$Fy\text{-}Gy \leqslant 3$	$Fy : 0^{+2,5}_{-2,5}$	$Fx : 0^{-2,5}_{+2,5}$	$Fy\text{-}Gy \leqslant 2,5$
$Gy : 0^{+3}_{-3}$	$Gx : 0^{+3}_{-3}$	$Gx\text{-}Jx \leqslant 3$	$Gy : 0^{+2,5}_{-2,5}$	$Gx : 0^{+2,5}_{-2,5}$	$Gx\text{-}Jx \leqslant 2,5$
$Jy : 0^{-3}_{+3}$	$Jx : 0^{+3}_{-3}$	$Jy\text{-}Hy \leqslant 3$	$Jy : 0^{-2,5}_{+2,5}$	$Jx : 0^{+2,5}_{-2,5}$	$Jy\text{-}Hy \leqslant 2,5$
$Hy : 0^{-3}_{+3}$	$Hx : 0^{-3}_{+3}$	$Hx\text{-}Fx \leqslant 3$	$Hy : 0^{-2,5}_{+2,5}$	$Hx : 0^{-2,5}_{+2,5}$	$Hx\text{-}Fx \leqslant 2,5$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 35 to 250 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

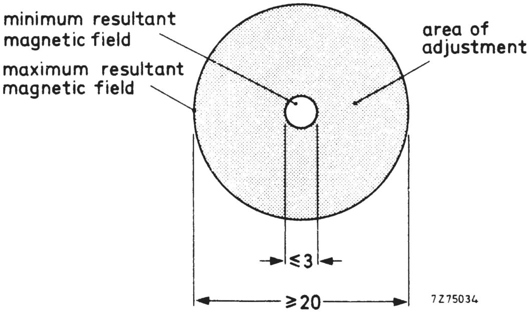

minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤3
≥20
7Z75034

Fig. 5 AT1076/01.

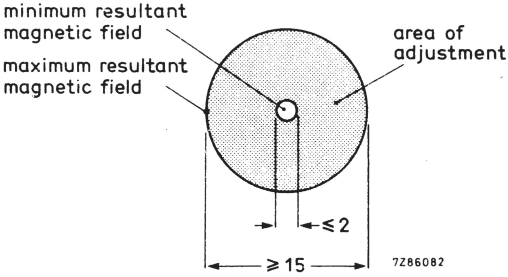

minimum resultant magnetic field
maximum resultant magnetic field
area of adjustment
≤2
≥15
7Z86082

Fig. 6 AT1076/02.

For geometric distortion

The unit has provisions for mounting brackets for magnet strips* to correct pin-cushion distortion, see Fig. 1.

Note: Comprehensive application information is available on request.

---

* Plastic-bonded Ferroxdure magnet strips (with bracket) are available under catalogue number 3122 137 60990.

LINE OUTPUT TRANSFORMER

QUICK REFERENCE DATA				
I_{eht}	35		435	μA
E.H.T.	17,7		16,2	kV
$R_{i(eht)}$		4,0		MΩ
Supply voltage (V_B)	188		186	V
current (I_B)	212		250	mA
I p-p deflection	2,20		2,15	A
Auxiliary voltages	−300 V p, +60 V p, −60 V p and 7,7 V r.m.s.			

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 43 cm (17 in) to 61 cm (24 in) 110 ° black and white picture tubes with a neck diameter of 28 mm in transistor equipped television receivers presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with:
- deflection unit AT1040/15
- adjustable linearity control unit AT4042/02
- line output transistor BU205
- E.H.T. rectifier device selenium stack.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores, clamped together with a bracket. The primary windings, the auxiliary windings and the E.H.T. windings are situated on one leg of the core. The E.H.T. windings are encapsulated in flame retardant polyester. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.
The transformer is provided with four mounting pins. External circuit connection is made to connecting pins, positioned as indicated in Fig. 1 enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions (in mm) and terminals

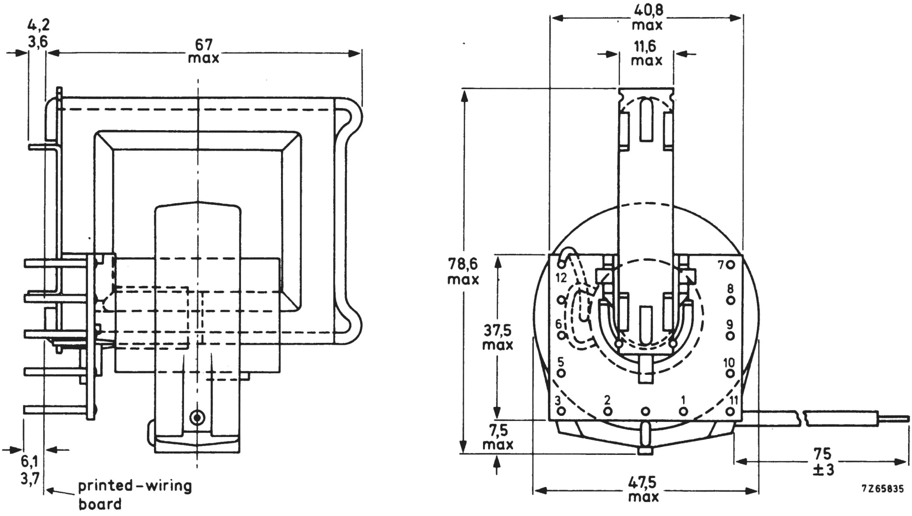

4,2
3,6
67
max
6,1
3,7
printed-wiring
board
40,8
max
11,6
max
78,6
max
37,5
max
7,5
max
47,5
max
75
±3
12
7
8
6
9
5
10
3
2
1
11
7Z65835

Fig. 1

Weight 155 g approximately

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting pins in a printed-wiring grid with a pitch of 2, 54 mm (0, 1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

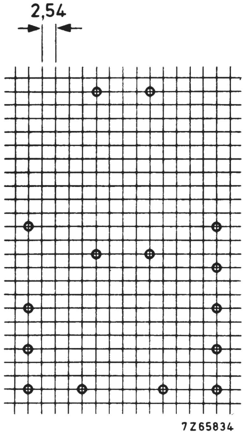


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side)
Grid holes 1, 3 ± 0, 1 mm

Temperature

The operating temperature of the core and the coils should not exceed 105 °C, under worst conditions, i.e. taking into account:

- overvoltage on the windings
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C).

To satisfy this requirement it may be desired to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces (in proportion to their sharpness protruding parts must have a greater distance) must be maintained:

a. From the e.h.t. winding, radially 25 mm
axially 15 mm

b. From the e.h.t. lead 25 mm

The transformer, and the leads and components carrying high voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see circuit diagram)

E.H.T. supply	I_{eht}	μA	35		435
	E.H.T.	kV	17,7		16,2
	$R_{i(eht)}$	MΩ		4,0	
Power supply	V_B	V		200	
	V_B'	V	188		186
	I_{av} 1)	mA	212		250
Output transistor	V_{CEM}	V	1080		1100
	I_{CM}	A	1,4		1,45
Deflection	I p-p	A	2,20		2,15
	Flyback ratio (average)	%		18	
	Overscan variation	%	6		10
Auxiliary windings,	connecting pin 5	V p	−300		
	connecting pin 7	V p	+60		
	connecting pin 9	V p	−60		
	connecting pins 10, 11	V r.m.s.	7,7		

---

1) Measured at pin 1

Circuit diagram

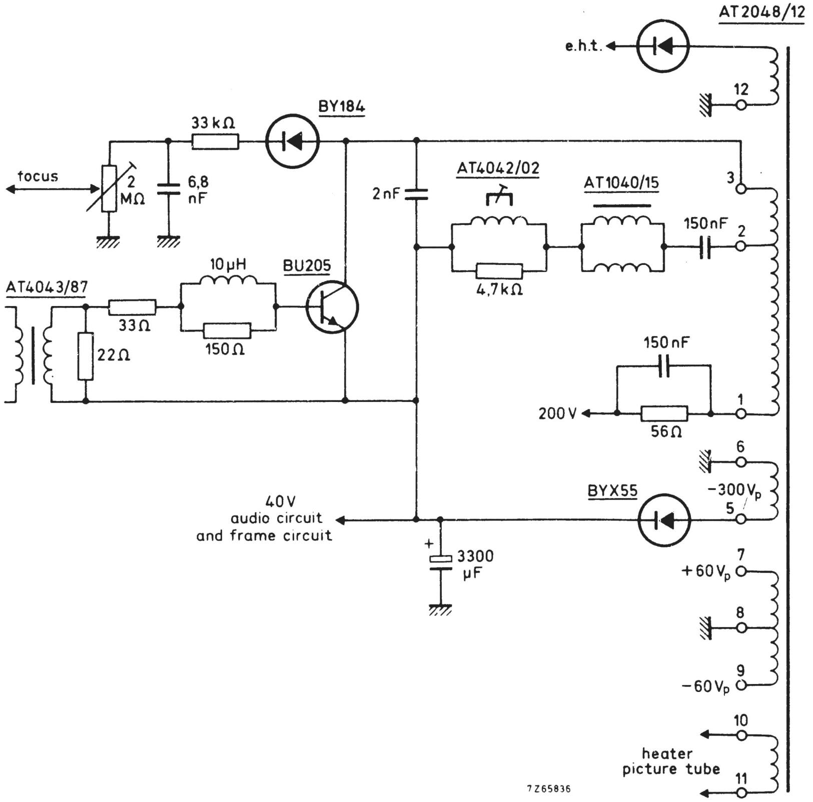

AT2048/12
e.h.t.
12
BY184
33 kΩ
focus
2 MΩ
6,8 nF
2 nF
AT4042/02
AT1040/15
3
150 nF
2
4,7 kΩ
AT4043/87
10 μH
BU205
33 Ω
150 Ω
22 Ω
150 nF
200 V
56 Ω
1
6
−300 V$_p$
5
BYX55
40 V
audio circuit
and frame circuit
+
3300 μF
7
+60 V$_p$
8
9
−60 V$_p$
10
heater
picture tube
11
7Z65836

Fig. 3

DIODE-SPLIT LINE OUTPUT TRANSFORMER

This transformer provides the required scanning amplitude for 110° and 90° black and white, and colour picture tubes, in transistor equipped television receivers.

For further information see section "Components for colour television".

UNIVERSAL DIODE-SPLIT LINE OUTPUT TRANSFORMER

- For monochrome Data Graphic Displays
- Three-layer e.h.t. coil
- Aluminium foil primary winding
- Piggy-back type

QUICK REFERENCE DATA

For transistor line output stages, deflection angle 110°, scan frequency 32 kHz.

I_{eht}	max. 0,5	mA
E.H.T.	17	kV
$R_{i(eht)}$	1,3	MΩ
$I_{p\text{-}p}$ deflection	3,8	A
Supply voltage (V_B)	129	V
Supply current ($I_{average}$)	210	mA
Flyback time	5,4	µs
Auxiliary voltages	+ 6 V, –6 V, + 11 V, + 26 V, + 41 V, + 52 V, –150 V, heater voltage 9,8 V(r.m.s.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 38 cm (15 in)/110° monochrome data graphic display tubes, at line scan frequencies of 15,625 kHz, 32 kHz or 64 kHz.
It is intended for use in conjunction with:

- deflection unit AT1039/00 (for 'portrait' scan mode, scan frequency 64 kHz) or AT1039/01 (for 'landscape' scan mode, scan frequency 15,625 kHz or 32 kHz);
- line output transistor BU508A;
- screened e.h.t. cable, length 1 m, catalogue number 3122 137 58254.

DESCRIPTION

The magnetic circuit of the transformer comprises 2 Ferroxcube U-cores, screwed together. The primary winding of aluminium foil and the secondary windings are situated on one leg of the core. The e.h.t. winding is moulded in flame retarding polyester, meeting the self-extinguishing requirements of IEC 65, para. 14.4 and UL492, para. 280-SE1. The transformer has 2 M3 screw-studs for mounting.* External circuit connection is made to connecting pins, positioned as indicated in Fig. 1, enabling the unit to be soldered directly into a printed-wiring board (Fig. 2).

---

* For mounting on the printed-wiring board a washer of 20 mm in diameter has to be used. Tightening torque on printed-wiring board: 500 + 100 mNm.

MECHANICAL DATA

Dimensions in mm

Outlines

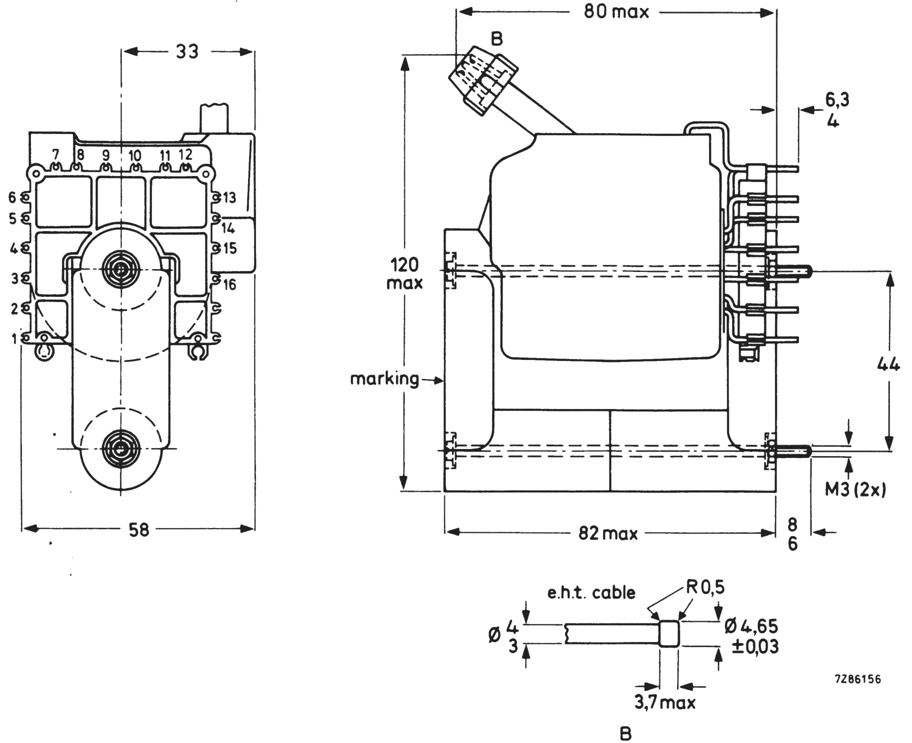

33
7
8
9
10
11
12
6
5
4
3
2
1
13
14
15
16
58
80 max
B
6,3
4
120
max
marking
44
M3 (2x)
82 max
8
6
e.h.t. cable
R 0,5
Ø 4
3
Ø 4,65
±0,03
3,7 max
7Z86156
B

Fig. 1.

Mass approx. 500 g

Solderability in accordance with IEC 68, Test T

MOUNTING

The transformer may be mounted on either a printed-wiring board or, under certain conditions, on a metal chassis. Two securing studs (M3) are provided. The fit of the connecting and the mounting pins in a printed-wiring grid with a pitch of 2,54 mm is illustrated in Fig. 2.

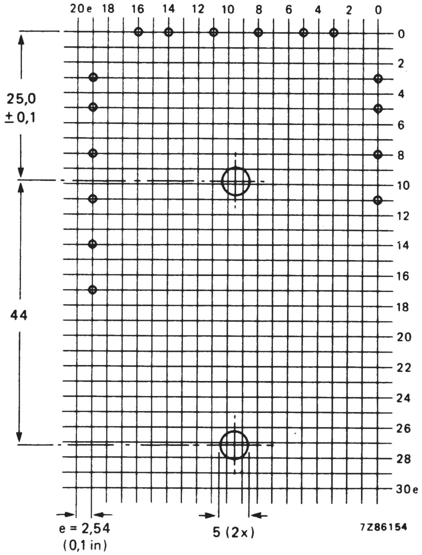


Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side). Grid hole diameter 1,3 ± 0,1 mm.

Whether the transformer is board or chassis mounted, **the core must be earthed.**

Temperature

The operating temperature of the e.h.t. coil should not exceed + 85 °C under worst conditions, i.e. taking into account:

- over-voltage on the coils;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high ambient temperature (up to 45 °C).

To satisfy this requirement it is recommended to provide sufficient flow of cool air around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained:

From the e.h.t. coil radially, 10 mm.
From the e.h.t. coil axially, 10 mm.

Sharp edges of conductive parts must have greater distances than given above.

The transformer, leads and components carrying high voltage pulses, should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA

Scan frequency		Hz	15625 (Fig. 3)		31250 (Fig. 4)		62500 (Fig. 5)	
E.H.T. supply	I_{eht}	mA	0,035	0,55	0,035	0,55	0,035	0,55
	e.h.t.	kV	17,3	16,8	17,85	17,25	17,6	16,6
	$R_{i(eht)}$	MΩ	1,1		1,3		2,0	
Power supply	V_B	V	68,5	68,5	129	129	100	100
	$I_{average}$	mA	385	530	210	285	310	410
Output transistor	V_{CEM}	V	560		1120		780	
Deflection	I_{p-p}	A	3,95	3,95	3,75	3,75	5,80	5,80
	$t_{flyback}$	μs	11,2	11,2	5,4	5,4	3,0	3,0
Tuning capacitor	C1	nF	20		2,2		1,6	
Auxiliary windings:								
heater voltage (r.m.s.)	V_{4-6}	V	9,53		9,83		9,92	
voltages (d.c.)* at								
pin 15 (V_{g2}, load 1MΩ)	V_{15}	V	+757		+842		+773	
pin 1 **	V_1	V	+49,7		+49,7		+55,4	
pin 3 **	V_3	V	+38,5		+38,5		+42,9	
pin 5 **	V_5	V	+24,5		+24,5		+27,3	
pin 2 (V_{g1}, load 10 kΩ)	V_2	V	−156		−166		−155	
pin 8 **	V_8	V	+10,5		+10,5		+11,8	
pin 11 **	V_{11}	V	+6,4		+6,4		+7,15	
pin 12 **	V_{12}	V	−6,4		−6,4		−7,15	

* Pins 9 and 10 connected to earth.

** Load 1 kΩ.

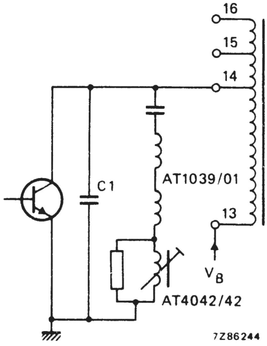

16
15
14
C1
AT1039/01
13
V_B
AT4042/42
7Z86244

Fig. 3.

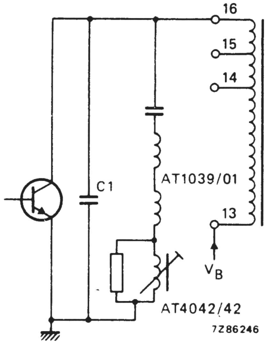

16
15
14
C1
AT1039/01
13
V_B
AT4042/42
7Z86246

Fig. 4.

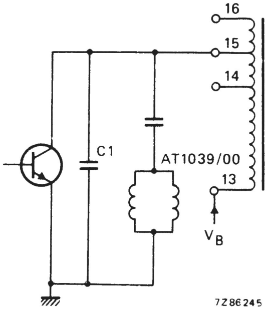

16
15
14
C1
AT1039/00
13
V_B
7Z86245

Fig. 5.

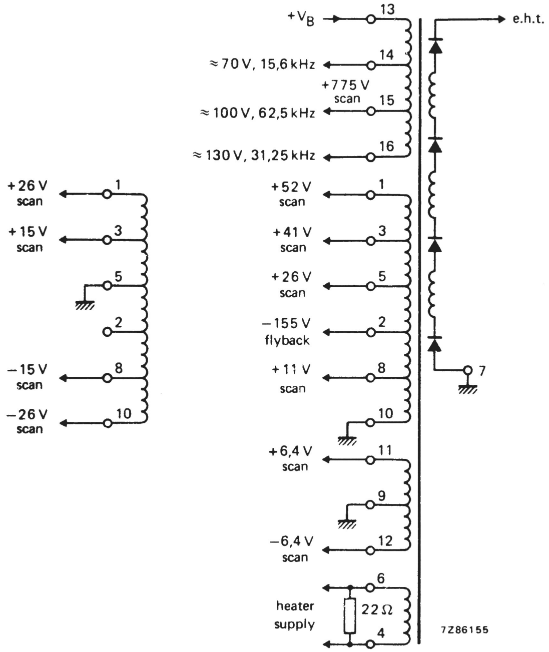

+V_B
13
e.h.t.
≈ 70 V, 15,6 kHz
14
+775 V scan
15
≈ 100 V, 62,5 kHz
16
≈ 130 V, 31,25 kHz
+26 V scan
1
+15 V scan
3
5
2
−15 V scan
8
−26 V scan
10
+52 V scan
1
+41 V scan
3
+26 V scan
5
−155 V flyback
2
+11 V scan
8
10
7
+6,4 V scan
11
9
−6,4 V scan
12
6
heater supply
22 Ω
4
7Z86155

Fig. 6 Application circuit.

LINE OUTPUT TRANSFORMER

QUICK REFERENCE DATA

	used in conjunction with AT1071/03		used in conjunction with AT1074/01	
I_{eht}	0 μA	100 μA	0 μA	100 μA
E.H.T.	14,9 kV	13,9 kV	14,7 kV	13,6 kV
$R_{i(eht)}$	10 MΩ		11 MΩ	
Supply voltage (V_B)	12 V	12 V	12 V	12 V
Supply current (I_B)	1725 mA	1825 mA	1700 mA	1800 mA
Deflection current	8,5 A	8,4 A	5,0 A (p-p)	4,95 A (p-p)
Auxiliary voltages	6,3 V (r.m.s.), 11 V (r.m.s.), 66 V (d.c.), 790 V (d.c.)			

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 24 cm (9 in) to 31 cm (12 in) 90° monochrome monitor tubes in video display monitors presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with the following packages of components:
deflection unit AT1071/03 or AT1071/07;
adjustable linearity control unit AT4036;
line driver transformer AT4043/64;

deflection unit AT1074/01;
adjustable linearity control unit AT4042/26;
line driver transformer AT4043/56.

DESCRIPTION

The magnetic circuit of the transformer comprises Ferroxcube U and I-cores clamped together with two screws. The primary windings and the auxiliary windings are situated on one leg of the core, the e.h.t. winding and the coupling winding are situated on the other leg. The e.h.t. winding is encapsulated in flame retardent polyester. An e.h.t. rectifier diode is incorporated in the transformer. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.

The transformer is provided with four mounting pins; it can also be screwed to the printed-wiring board. External circuit connection is made to connecting pins, enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

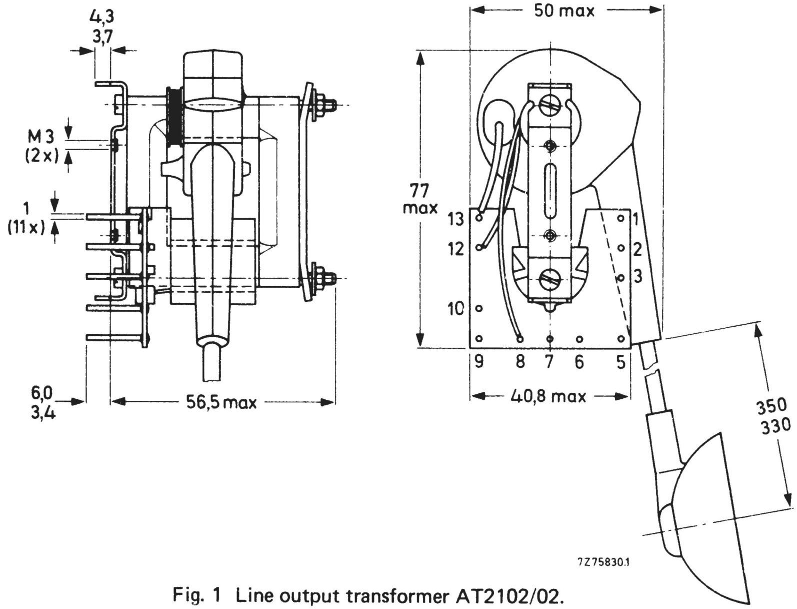

4,3
3,7
M3
(2x)
1
(11x)
6,0
3,4
56,5 max
50 max
77
max
13
12
10
9
8
7
6
5
1
2
3
40,8 max
350
330
7Z75830.1

Fig. 1 Line output transformer AT2102/02.

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

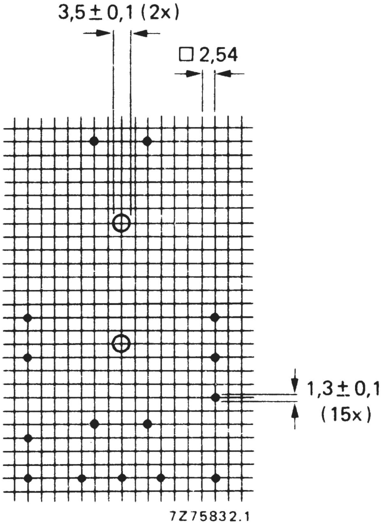

3,5 ± 0,1 (2x)
□ 2,54
1,3 ± 0,1
(15x)
7Z75832.1

Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

over-voltage on the windings;
low atmospheric pressure (at high altitudes) implying bad cooling by convection;
high room temperature (up to 45 °C).

To satisfy this requirement it may be desired to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

a. From the e.h.t. winding, radially 15 mm, axially 10 mm.
b. From the e.h.t. lead 25 mm.

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see also Figs 3 and 4)

		AT2102/02 used in conjunction with AT1071/03		AT2102/02 used in conjunction with AT1074/01	
E.H.T. supply	I_{eht}	0 µA	100 µA	0 µA	100 µA
	E.H.T.	14,9 kV	13,9 kV	14,7 kV	13,6 kV
	$R_{i(eht)}$	10 MΩ		11 MΩ	
Power supply	V_B	12 V	12 V	12 V	12 V
	I_{av}	1725 mA	1825 mA	1700 mA	1800 mA
Output transistor	V_{CEM}	144 V	144 V	142 V	142 V
	I_{CM}	6,4 A	6,4 A	6,2 A	6,2 A
Deflection	Current	8,5 A (p-p)	8,4 A (p-p)	5,0 A(p-p)	4,95 A (p-p)
	Flyback time	9,9 µs	9,9 µs	10 µs	10 µs
	Scan variation	1,5 %		2%	

Auxiliary windings

connecting pins 1 and 2	6,3 V (r.m.s.)
connecting pins 1 and 3	11 V (r.m.s.)
connecting pin 5 (pin 6 connected to earth)	790 V (d.c.)
connecting pin 7 (pin 6 connected to earth)	66 V (d.c.)

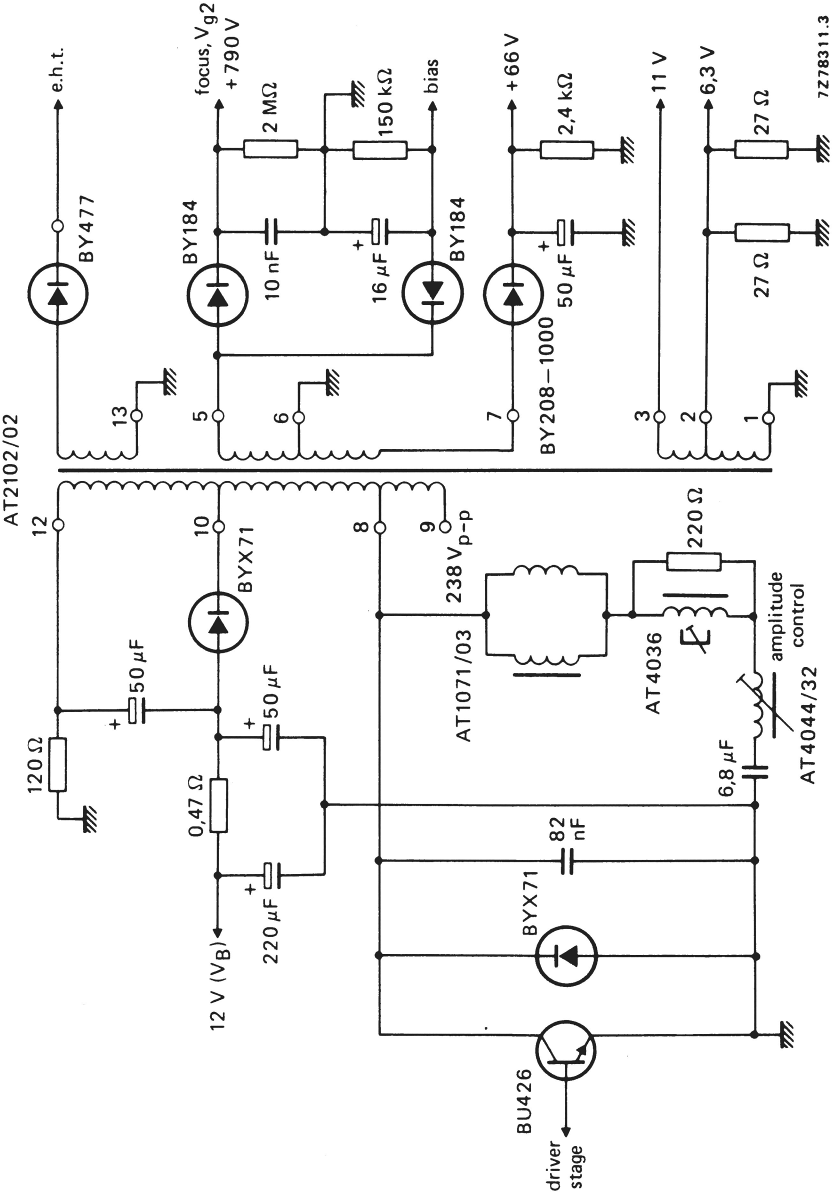

e.h.t.
focus, V_{g2}, +790 V
bias
+66 V
11 V
6,3 V
7Z78311.3
BY477
BY184
BY184
2 MΩ
150 kΩ
10 nF
16 µF
2,4 kΩ
50 µF
BY208–1000
27 Ω
27 Ω
13
5
6
7
3
2
1
AT2102/02
12
10
8
9
238 V_{p-p}
BYX71
120 Ω
50 µF
50 µF
0,47 Ω
220 µF
12 V (V_B)
AT1071/03
AT4036
220 Ω
amplitude control
AT4044/32
6,8 µF
82 nF
BYX71
BU426
driver stage

Fig. 3 Application circuit for use with deflection units AT1071/03 and AT1071/07.

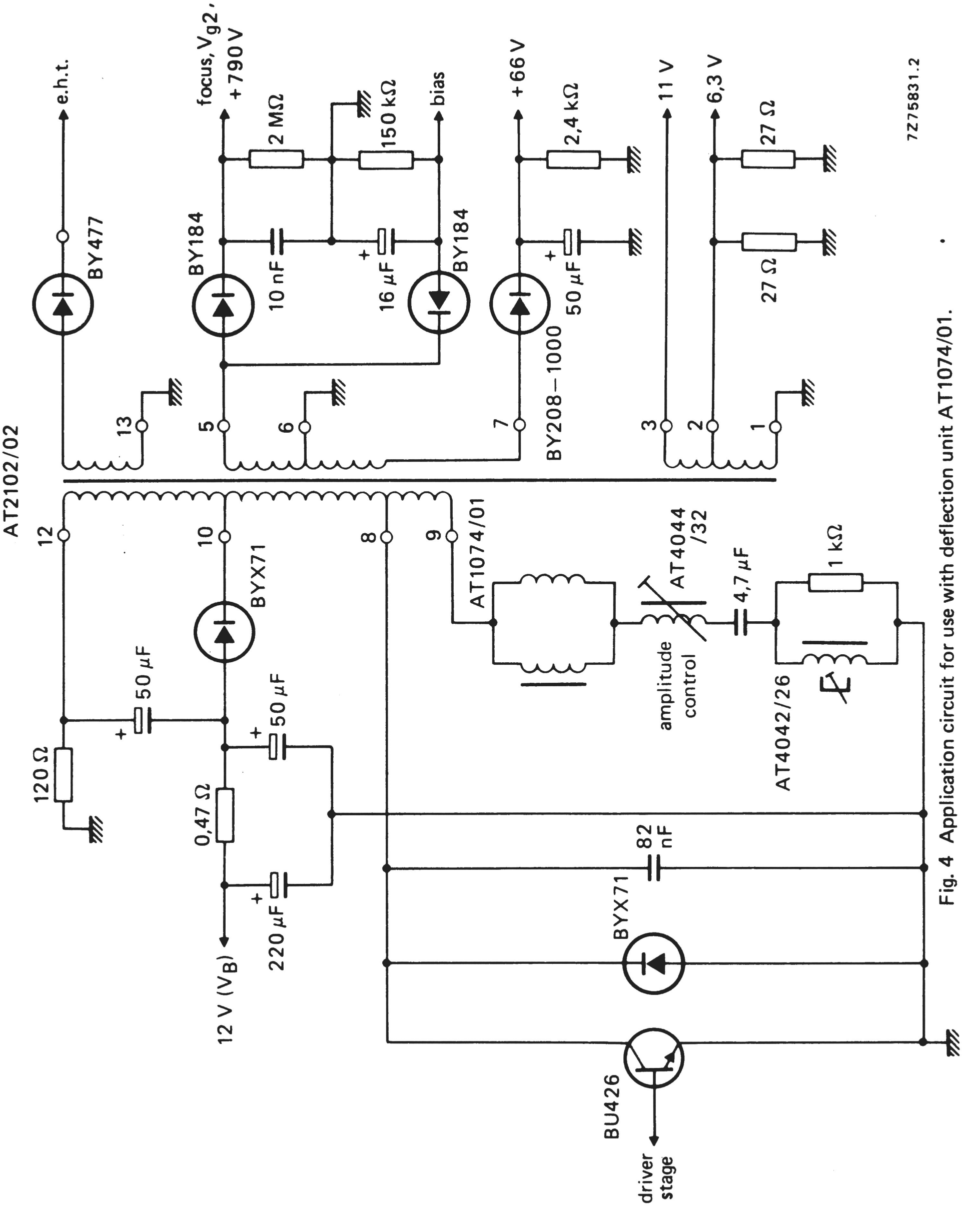

e.h.t.
BY477
13
focus, V_{g2},
+790 V
2 MΩ
150 kΩ
bias
BY184
10 nF
16 μF
BY184
5
6
+66 V
2,4 kΩ
50 μF
BY208−1000
7
11 V
6,3 V
27 Ω
27 Ω
3
2
1
7Z75831.2
AT2102/02
12
10
8
9
AT1074/01
BYX71
AT4044
/32
4,7 μF
1 kΩ
amplitude
control
AT4042/26
50 μF
120 Ω
50 μF
0,47 Ω
220 μF
12 V (V_B)
82
nF
BYX71
BU426
driver
stage

Fig. 4 Application circuit for use with deflection unit AT1074/01.

LINE OUTPUT TRANSFORMER

QUICK REFERENCE DATA

I_{eht}	0 μA	100 μA
E.H.T.	17 kV	16,35 kV
$R_{i(eht)}$	6,5 MΩ	
Supply voltage (V_B)	24 V	24 V
Supply current (I_B)	820 mA	910 mA
Deflection current	4,6 A (p-p)	4,6 A (p-p)
Auxiliary voltages	6,3 V (r.m.s.), 25 V (d.c.), 70 V (d.c.), 800 V (d.c.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 31 cm (12 in) to 38 cm (15 in) 110° monochrome monitor tubes with a neck diameter of 28 mm in video display monitors presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with:
deflection unit AT1038/40;
adjustable linearity control unit AT4042/08;
line driver transformer AT4043/59;
e.h.t. cable with a length of 450 mm (catalogue number 3111 108 18450).

DESCRIPTION

The magnetic circuit of the transformer comprises Ferroxcube U and I-cores, clamped together with two screws. The primary windings, the auxiliary windings and the e.h.t. winding are situated on one leg of the core, and are encapsulated in flame retardent polyester. An e.h.t. rectifier diode is incorporated in the transformer. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.

The transformer is provided with four mounting pins; it can also be screwed to the printed-wiring board. External circuit connection is made to connecting pins, enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

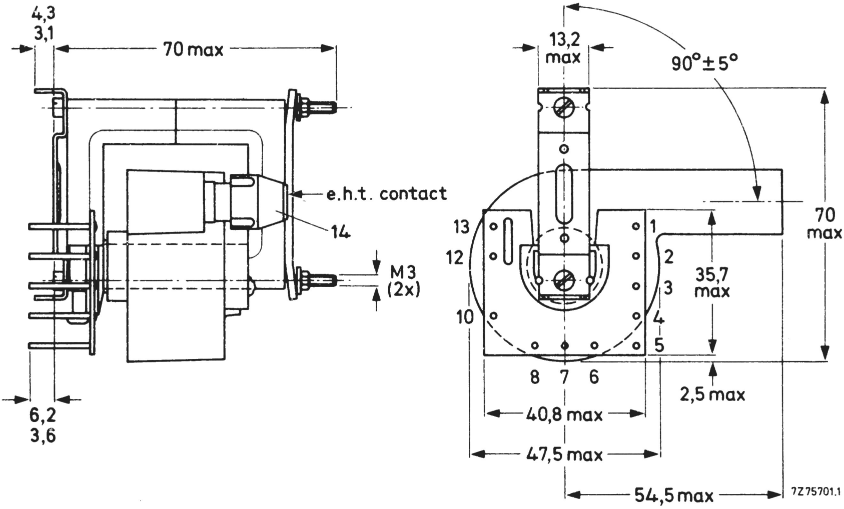

4,3
3,1
70 max
e.h.t. contact
14
M3
(2x)
6,2
3,6
13,2
max
90° ± 5°
70
max
13
12
10
1
2
3
4
5
8
7
6
35,7
max
2,5 max
40,8 max
47,5 max
54,5 max
7Z75701.1

Fig. 1a Line output transformer AT2102/04.

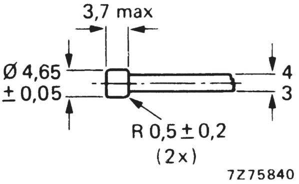

3,7 max
Ø 4,65
± 0,05
4
3
R 0,5 ± 0,2
(2x)
7Z75840

Fig. 1b E.H.T. contact (transformer side).

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

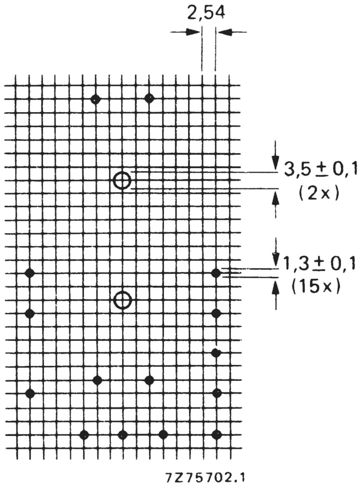

2,54
3,5 ± 0,1
(2x)
1,3 ± 0,1
(15x)
7Z75702.1

Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

over-voltage on the windings;
low atmospheric pressure (at high altitudes) implying bad cooling by convection;
high room temperature (up to 45 °C).

To satisfy this requirement it may be desired to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

a. From the e.h.t. winding, radially 15 mm, axially 10 mm.
b. From the e.h.t. lead 25 mm.

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see also Fig. 3)

E.H.T. supply	I_{eht}	0 µA	100 µA
	E.H.T.	17 kV	16,35 kV
	$R_{i(eht)}$	6,5 MΩ	
Power supply	V_B	24 V	24 V
	I_{av}	820 mA	910 mA
Output transistor	V_{CEM}	440 V	440 V
	I_{CM}	3,6 A	3,6 A
Deflection	Current	4,6 A (p-p)	4,6 A (p-p)
	Flyback time	10,5 µs	10,5 µs
	Overscan variation	1,5%	

Auxiliary windings

connecting pins 1 and 2	6,3 V (r.m.s.)
connecting pin 4 (pin 5 connected to earth)	25 V (d.c.)
connecting pin 3 (pin 5 connected to earth)	70 V (d.c.)
connecting pin 7 (pin 6 connected to earth)	800 V (d.c.)

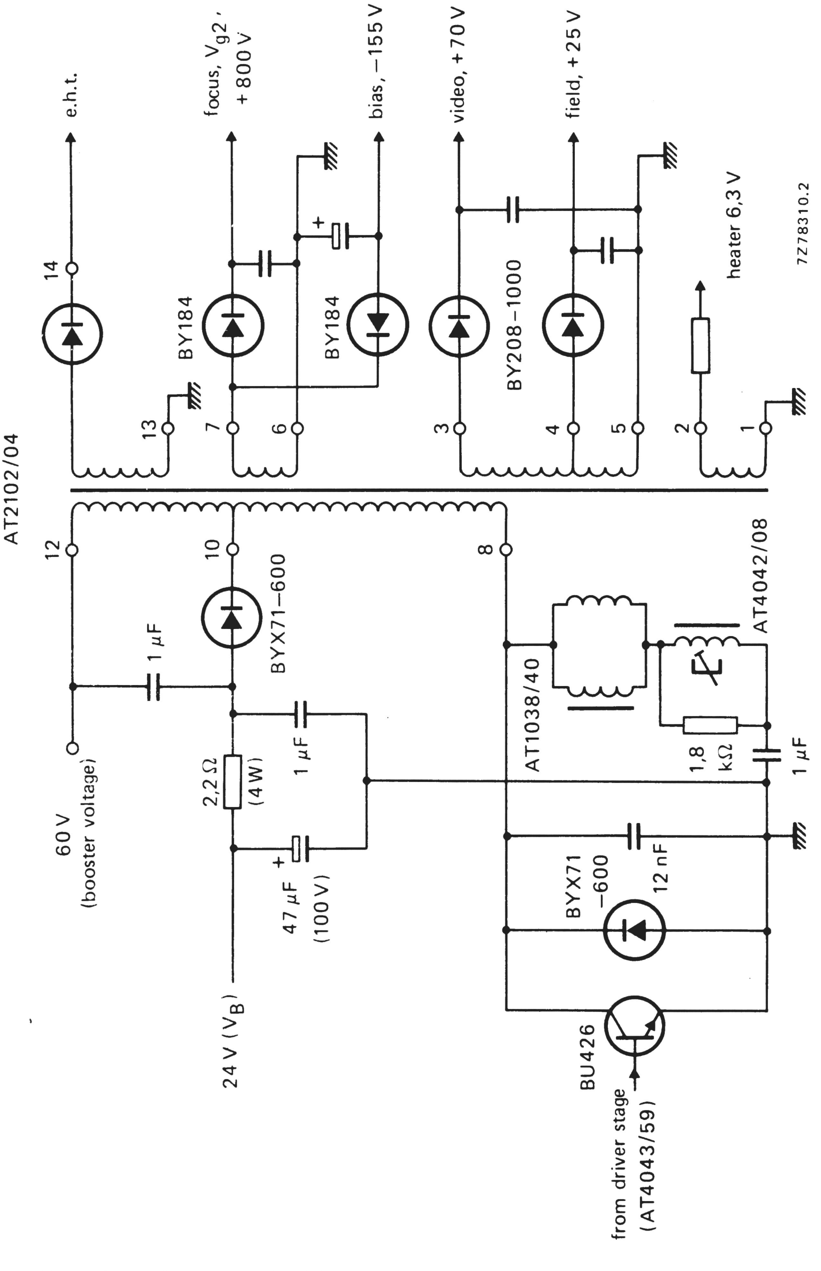

AT2102/04
e.h.t.
14
13
focus, V_{g2}, + 800 V
bias, −155 V
BY184
BY184
7
6
video, + 70 V
field, + 25 V
3
4
5
BY208−1000
heater 6,3 V
2
1
7Z78310.2
12
10
8
60 V (booster voltage)
1 µF
BYX71−600
2,2 Ω (4 W)
1 µF
+ 47 µF (100 V)
24 V (V_B)
AT1038/40
AT4042/08
1,8 kΩ
1 µF
12 nF
BYX71 −600
BU426
from driver stage (AT4043/59)

Fig. 3 Application circuit.

LINE OUTPUT TRANSFORMER

- **For Data Graphic Displays**

QUICK REFERENCE DATA

I_{eht}	0 μA	100 μA
E.H.T.	17,0 kV	16,2 kV
$R_{i(eht)}$	8 MΩ	
Supply voltage (V_B)	24 V	
Supply current (I_B)	955 mA	
Deflection current	4,4 A (p-p)	4,35 A (p-p)
Auxiliary voltages	6,4 V (r.m.s.), 87,6 V (d.c.), 905 V (d.c.), −144 V (d.c.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 31 cm (12 in) to 38 cm (15 in) 110° CRTs with a neck diameter of 28 mm in video display monitors.

The line frequency is set to 21,3 kHz at a fly-back time of 8,0 μs. With a small modification the line frequency can be reduced to 19 kHz. A frame frequency of 50 or 60 Hz is possible without modification.

The transformer is intended for use in conjunction with:
deflection unit AT1038/40;
adjustable linearity control unit AT4042/42;
line driver transformer AT4043/59;
e.h.t. cable with a length of 450 mm (catalogue number 3111 108 18450).

Note
The transformer was originally developed for data display of 80 characters per row, 28 rows per page, having a 7 x 9 character matrix in a 9 x 14 character cell; dynamic focusing was applied in the line direction to improve picture performance.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores, clamped together with two screws. The primary windings, the auxiliary windings and e.h.t. winding are situated on one leg of the core, and are encapsulated in flame retardent polyester. An e.h.t. rectifier diode is incorporated in the transformer. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.

The transformer is provided with four mounting pins; it can also be screwed to the printed-wiring board. External circuit connection is made to connecting pins, enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

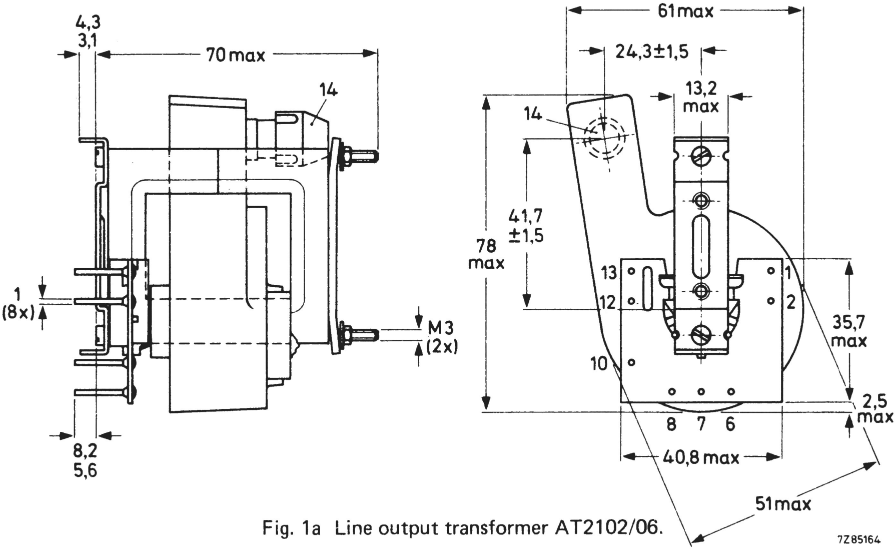

4,3
3,1
70 max
14
1
(8x)
M3
(2x)
8,2
5,6
61 max
24,3±1,5
13,2
max
14
41,7
±1,5
78
max
13
12
10
1
2
35,7
max
2,5
max
8
7
6
40,8 max
51 max
7Z85164

Fig. 1a Line output transformer AT2102/06.

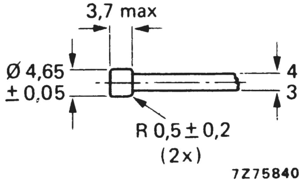

3,7 max
Ø 4,65
± 0,05
4
3
R 0,5 ± 0,2
(2x)
7Z75840

Fig. 1b E.H.T. contact (transformer side).

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

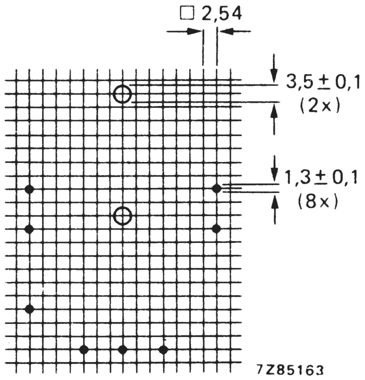

□ 2,54
3,5 ± 0,1
(2x)
1,3 ± 0,1
(8x)
7Z85163

Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

over-voltage on the windings;
low atmospheric pressure (at high altitudes) implying bad cooling by convection;
high room temperature (up to 45 °C).

To satisfy this requirement it may be desired to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

a. From the e.h.t. winding, radially 15 mm, axially 10 mm.
b. In general such that no corona occurs at 10% over-voltage of e.h.t., at an air pressure of 60 kPa and a relative humidity of 85%.

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see also Fig. 3)

E.H.T. supply	I_{eht}	0 μA	100 μA
	E.H.T.	17,0 kV	16,2 kV
	$R_{i(eht)}$	8 MΩ	
Power supply	V_B	24 V	
	I_B	955 mA	
Output transistor	V_{CEM}	720 V	
	I_{CM}	3,3 A	
Deflection	Current	4,4 A (p-p)	
	Flyback time	8,0 μs	
	Overscan variation (edge to edge)	0,5 %	

Auxiliary windings

connecting pins 1 and 2; load 300 mA	6,4 V (r.m.s.) ± 5,5%
connecting pin 12; load 40 mA	87,6 V (d.c.)
connecting pin 7 (pin 6 connected to earth); load 0,7 mA	905 V (d.c.) ± 5,5%
load 0,3 mA	−144 V (d.c.) ± 5,5%

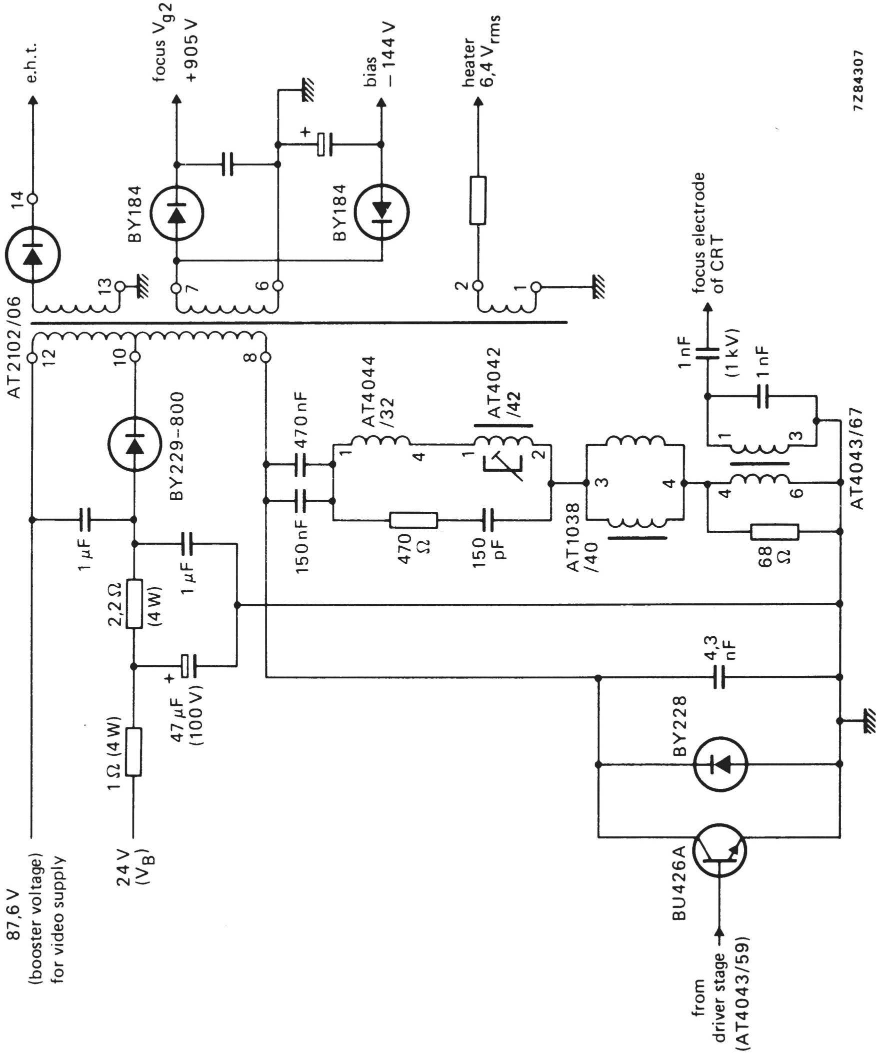

e.h.t.
focus V_{g2}
+905 V
bias
−144 V
heater
6,4 V_{rms}
7Z84307
14
13
BY184
BY184
7
6
2
1
AT2102/06
12
10
8
BY229-800
1 μF
1 μF
2,2 Ω
(4 W)
47 μF
(100 V)
+
+
1 Ω (4 W)
24 V
(V_B)
87,6 V
(booster voltage)
for video supply
470 nF
150 nF
AT4044
/32
1
4
AT4042
/42
1
2
470
Ω
150
pF
AT1038
/40
3
4
focus electrode
of CRT
1 nF
(1 kV)
1 nF
1
3
4
6
68
Ω
AT4043/67
4,3
nF
BY228
BU426A
from
driver stage
(AT4043/59)

Fig. 3 Application circuit.

TESTS AND REQUIREMENTS

The line output transformer withstands the following tests.

IEC 68–2 test method	name of test	procedure (quick reference)
Ua1	Tensile strength of terminations	
Ub (method 1)	Bending of terminations	
Fc	Vibration	Frequency range 10-55-10 Hz, amplitude 0,35 mm, 3 directions, 30 min per direction
Eb	Bump	250 bumps in 5 directions, acceleration 25 g.
Ea	Shock	Half-sine pulse shape, 11 ms, 490 m/s^2, 6 directions, 3 shocks per direction.
Ta (method 1)	Soldering	Solder temp. 230 °C, dwell time 2 s.
Bb	Dry heat	96 h at +100 °C.
Db	Damp heat, cyclic	21 cycles of 24 h at +40 °C, R.H. 95%.
Ab	Cold	96 h at −25 °C.
M	Low air pressure	+55 °C, 60 kPa, 30 min.
Ca	Damp heat, steady state	21 days.
Na	Rapid change of temperature	5 cycles of −25 °C/+100 °C.
	Flammability of transformer (IEC65-14.4); power test	10 W, 20 W, 30 W and 40 W successively, for 2 min until encapsulation of e.h.t. coil cracks.
	Flammability of materials (UL94, class V1)	Line output transformer is self-extinguishing.

LINE OUTPUT TRANSFORMER
with integral e.h.t. rectifier diode

QUICK REFERENCE DATA	
I_{eht}	25 μA
E.H.T.	10,2 kV
$R_{i(eht)}$	≤ 5,5 MΩ
Supply voltage (V_B) current (I_B)	10,4 V 0,86 A
I(p-p) deflection	4,9 A
Auxiliary voltages 11,2 V (a.c.), +350 V(d.c.), +100 V(d.c.), +13 V(d.c.), +25 V(d.c.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 31 cm (12 in) and 34 cm (14 in) 110° black and white picture tubes with a neck diameter of 20 mm in transistor equipped television receivers presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with:
- deflection unit AT 1074;
- line output transistor BU407.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores, clamped together with a bracket. The primary winding, the auxiliary windings and the e.h.t. winding are situated on one leg of the core. An e.h.t. rectifier diode is incorporated in the transformer. The e.h.t. winding is encapsulated in flame retardent polyester.
The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.
The transformer is provided with four mounting pins. External circuit connection is made to connecting pins, positioned as indicated in Fig. 1 enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

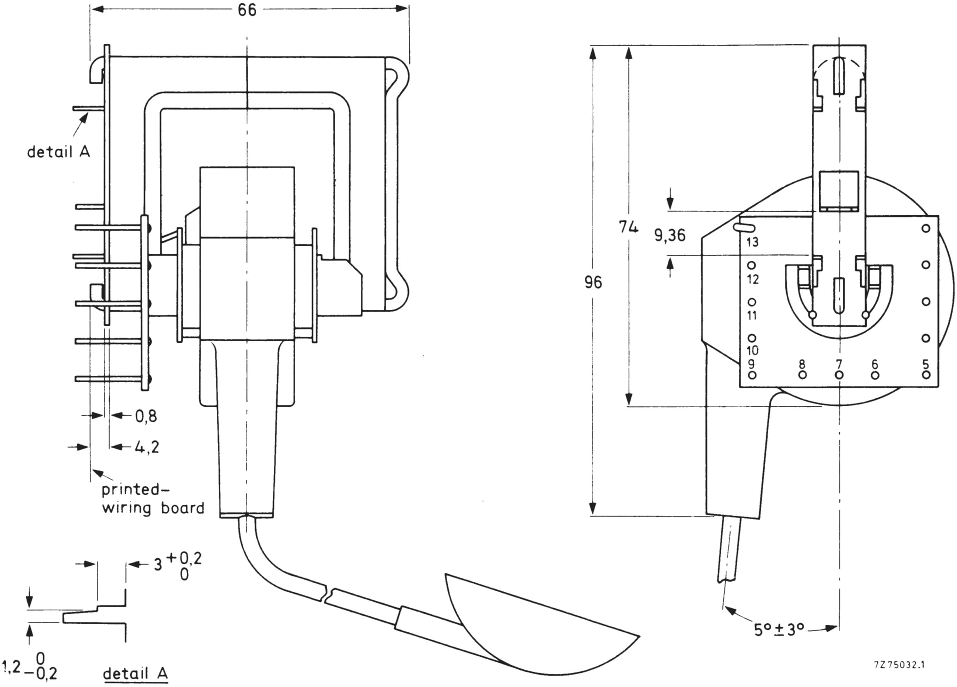

66
detail A
0,8
4,2
printed-wiring board
$3^{+0,2}_{0}$
$1,2^{0}_{-0,2}$
detail A
74
96
9,36
13
12
11
10
9
8
7
6
5
5° ± 3°
7Z75032.1

Fig. 1

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

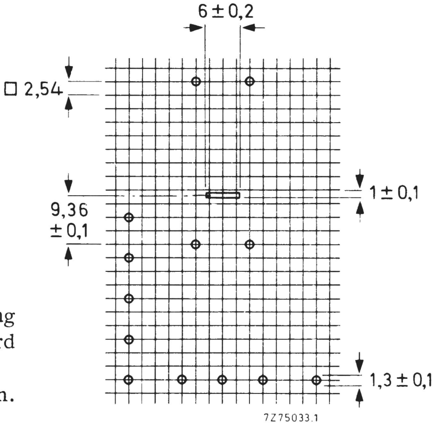


Fig. 2. Hole pattern for mounting on a printed-wiring board (solder side).
Grid holes 1,3 ± 0,1 mm.

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

- over-voltage on the windings;
- low atmospheric pressure (at high altitudes) implying bad cooling by convection;
- high room temperature (up to 45 °C).

To satisfy these requirements it may be desirable to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

a. From the e.h.t. winding,	radially	15 mm
	axially	10 mm
b. From the e.h.t. lead		15 mm

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see circuit diagram)

E.H.T. supply	I_{eht}	μA	25		250
	E.H.T.	kV	10,2		9,0
	$R_{i(eht)}$	MΩ		≤ 5,5	
Power supply	V_B	V		10,4	
	I_B	mA	860		
Output transistor	V_{CEM}	V (p-p)	160		
	I_{CM}	A (p-p)	3,4		
Deflection	$I_{(p-p)}$	A	4,9		
	Flyback ratio (average)	%	19		
	Overscan variation	%	6		10
Auxiliary windings,	connecting pin 5	V	11,2 (booster voltage)		
	connecting pin 9	V (d.c.)	+350		
	connecting pin 10 [1]	V (d.c.)	+100		
	connecting pin 11	V (d.c.)	+13		
	connecting pin 12	V (d.c.)	+25		

---

[1] After rectification.

Circuit diagram

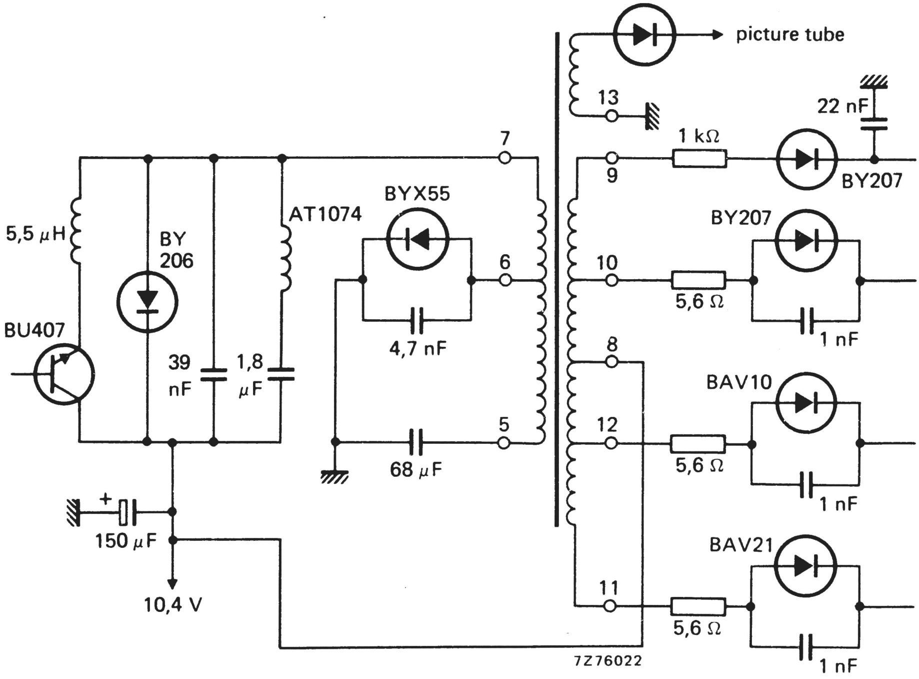

picture tube
13
22 nF
1 kΩ
7
9
BY207
BYX55
AT1074
BY207
5,5 μH
BY
206
6
10
5,6 Ω
4,7 nF
1 nF
BU407
39
nF
1,8
μF
8
BAV10
5
12
68 μF
5,6 Ω
1 nF
+
150 μF
BAV21
10,4 V
11
5,6 Ω
7Z76022
1 nF

Fig. 3

LINE OUTPUT TRANSFORMER

QUICK REFERENCE DATA

I_{eht}	0 μA	100 μA
E.H.T.	11 kV	10,2 kV
$R_{i(eht)}$	8 MΩ	
Supply voltage (V_B)	8,8 V	8,8 V
Supply current (I_B)	920 mA	1100 mA
Deflection current	4,2 A (p-p)	4,1 A (p-p)
Auxiliary voltages	15 V (d.c.), 75 V (d.c.), 200 V (d.c.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 31 cm (12 in) and 34 cm (14 in) 90° monochrome monitor tubes with a neck diameter of 20 mm in video display monitors presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with:
deflection unit AT1074;
adjustable linearity control unit AT4042/26;
line driver transformer AT4043/56.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores, clamped together with a bracket. The primary winding, the auxiliary windings and the e.h.t. winding are situated on one leg of the core. An e.h.t. rectifier diode is incorporated in the transformer. All windings are encapsulated in flame retardent polyester. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.

The transformer is provided with four mounting pins. External circuit connection is made to connecting pins, enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

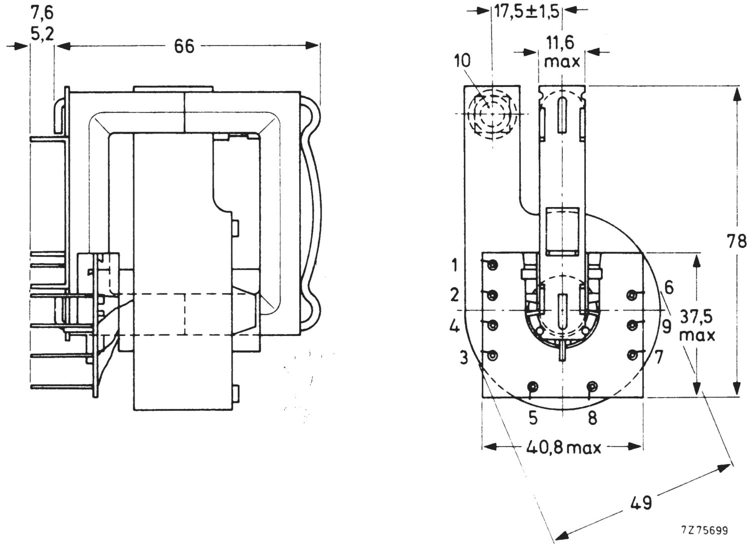

7,6
5,2
66
17,5±1,5
11,6 max
10
78
1
2
4
3
6
9
7
37,5 max
5
8
40,8 max
49
7Z75699

Fig. 1 Line output transformer AT2140/10.

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2. The core of the transformer must be earthed.

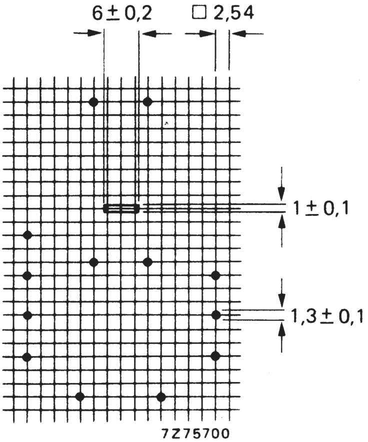

6 ± 0,2
□ 2,54
1 ± 0,1
1,3 ± 0,1
7Z75700

Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

over-voltage on the windings;
low atmospheric pressure (at high altitudes) implying bad cooling by convection;
high room temperature (up to 45 °C).

To satisfy these requirements it may be desirable to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

a. From the e.h.t. winding, radially 18 mm, axially 10 mm.
b. From the e.h.t. lead 15 mm.

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.

ELECTRICAL DATA (see also Fig. 3)

E.H.T. supply	I_{eht}	0 µA	100 µA
	E.H.T.	11 kV	10,2 kV
	$R_{i(eht)}$	8 MΩ	
Power supply	V_B	8,8 V	8,8 V
	I_B	920 mA	1100 mA
Output transistor	V_{CEM}	220 V	220 V
	I_{CM}	3,6 A	3,7 A
Deflection	Current	4,2 A (p-p)	4,1 A (p-p)
	Flyback ratio (average)	9,4 %	9,4 %
	Overscan variation	0 %	0 %

Auxiliary windings

connecting pin 1	200 V (d.c.)
connecting pin 2	75 V (d.c.)
connecting pin 4	15 V (d.c.)

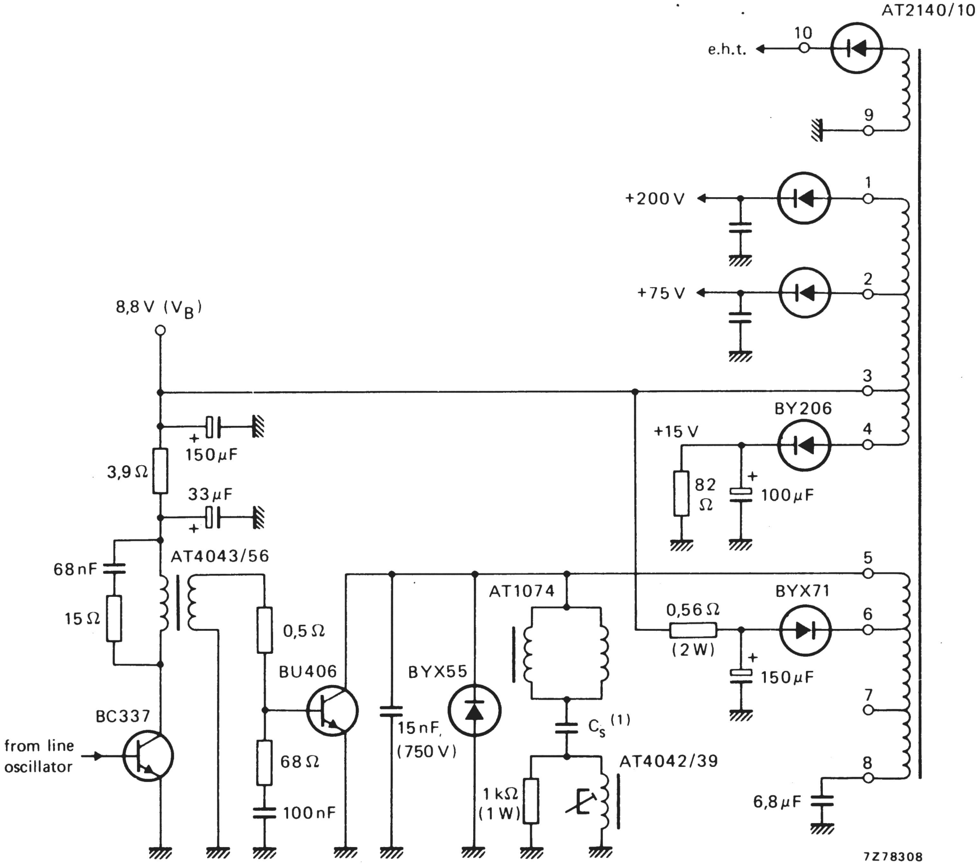

AT2140/10
10
e.h.t.
9
1
+200 V
2
+75 V
3
4
BY206
+15 V
82 Ω
100 μF
5
BYX71
6
0,56 Ω (2 W)
150 μF
7
8
6,8 μF
8,8 V (V_B)
150 μF
3,9 Ω
33 μF
68 nF
15 Ω
AT4043/56
0,5 Ω
BU406
68 Ω
100 nF
BC337
from line oscillator
15 nF (750 V)
BYX55
AT1074
C_s (1)
AT4042/39
1 kΩ (1 W)
7Z78308

Fig. 3 Application circuit. (1) $C_s = 1{,}5\ \mu F + 0{,}22\ \mu F + 1{,}5\ \mu F$.

LINE OUTPUT TRANSFORMER

- **For Data Graphic Displays**

QUICK REFERENCE DATA

I_{eht}	0 µA	100 µA
E.H.T.	11,5 kV	10,6 kV
$R_{i(eht)}$	9 MΩ	
Supply voltage (V_B)	12 V	
Supply current (I_B)	440 mA	530 mA
Deflection current	2,7 A (p-p)	2,7 A (p-p)
Auxiliary voltages	11 V (r.m.s.), −60 V (d.c.), 450 V (d.c.)	

APPLICATION

This transformer has been designed to provide the required scanning amplitude for 24 cm (9 in) to 31 cm (12 in) 90° monochrome monitor tubes in video display monitors presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with deflection unit AT1076/01 or AT1076/02 and linearity corrector AT4042/46.

DESCRIPTION

The magnetic circuit of the transformer comprises two Ferroxcube U-cores. The primary windings, the auxiliary windings and e.h.t. winding are situated on one leg of the core, and are encapsulated in flame retardent polyester. An e.h.t. rectifier diode is incorporated in the transformer. The whole transformer meets the self-extinguishing and non-dripping properties of the American Underwriters' Laboratories rating mentioned in UL94SE-1.

The transformer has an unscreened e.h.t. cable, length 260 mm, with e.h.t. cap. External circuit connection is made to connecting pins, enabling the unit to be soldered directly into a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

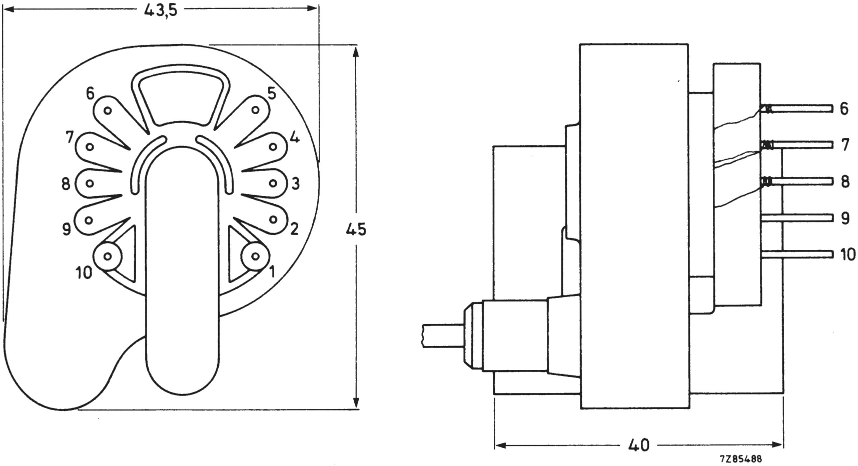

43,5
45
40
6
5
7
4
8
3
9
2
10
1
6
7
8
9
10
7Z85488

Fig. 1.

MOUNTING

The transformer may be mounted on a printed-wiring board. The fit of the connecting pins in a printed-wiring grid with a pitch of 2,54 mm (0,1 in) is illustrated in Fig. 2.

The core of the transformer must be earthed.

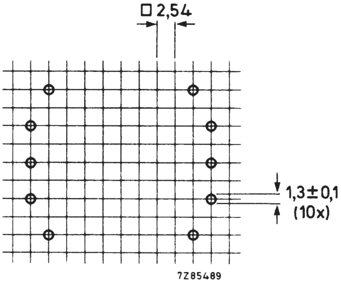

□ 2,54
1,3±0,1
(10x)
7Z85489

Fig. 2 Hole pattern for mounting on a printed-wiring board (solder side).

Temperature

The operating temperature of the core and the coils should not exceed 90 °C, under worst conditions, i.e. taking into account:

over-voltage on the windings;
low atmospheric pressure (at high altitudes) implying bad cooling by convection;
high room temperature (up to 45 °C).

To satisfy this requirement it may be desired to provide ample cool air circulation around the transformer.

Distances

The following minimum distances between the transformer and neighbouring conductive flat surfaces must be maintained (in proportion to their sharpness protruding parts must have a greater distance):

from the e.h.t. winding, radially 15 mm, axially 10 mm.

The transformer, and the leads and components carrying high-voltage pulses should be kept free from metal particles, solder drops etc.
The bending radius of the e.h.t. cable must be ⩾ 7,5 mm.

ELECTRICAL DATA (see also Fig. 3)

AT2140/16 used in conjunction with AT1076/02 and AT4042/46

E.H.T. supply	I_{eht}	0 μA	100 μA
	E.H.T.	11,5 kV	10,6 kV
	$R_{i(eht)}$	9 MΩ	
Power supply	V_B	12 V	
	I_B	440 mA	530 mA
Output transistor	V_{CEM}	270 V	
	I_{CM}	2 A	
Deflection	Current	2,7 A (p-p)	
	Flyback time	8,5 μs	
	Overscan variation (edge to edge)	5 %	

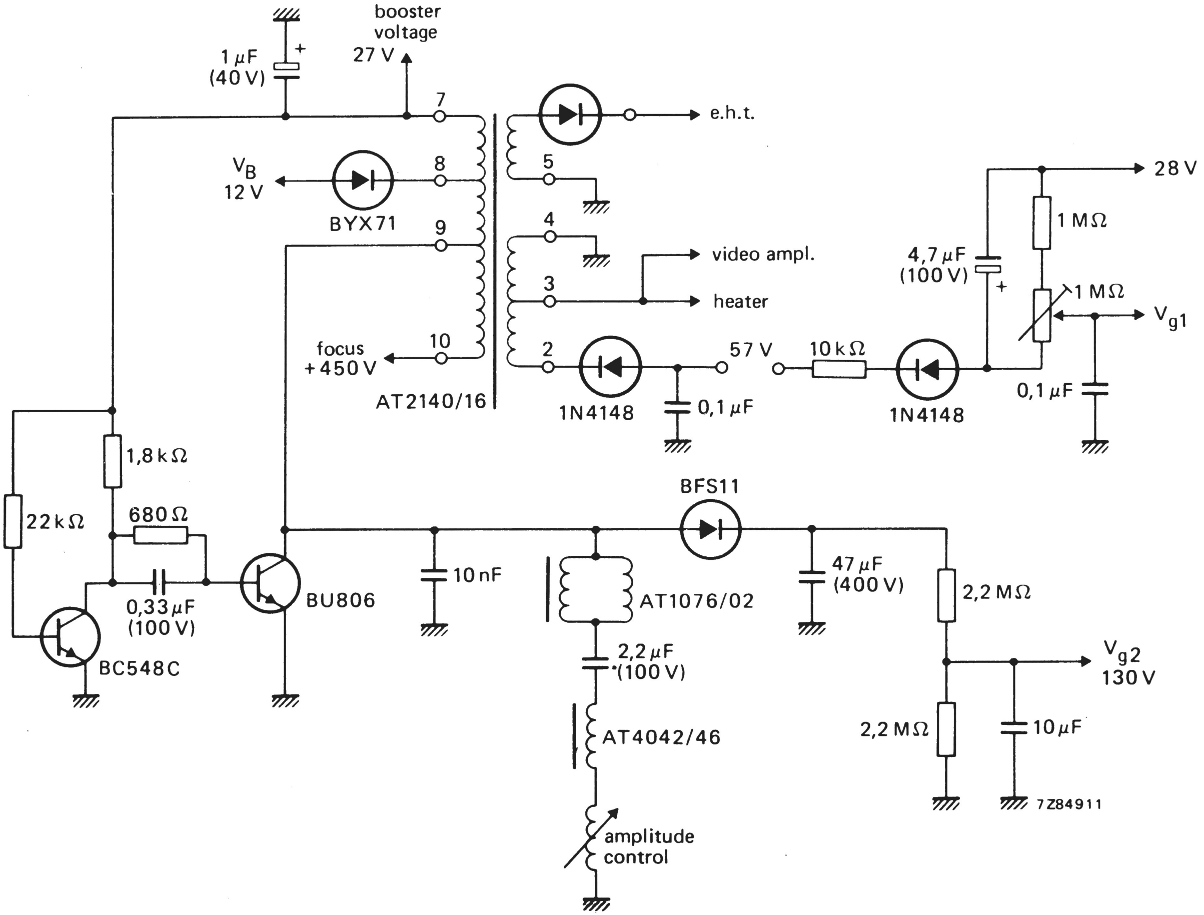

booster
voltage
27 V
1 μF
(40 V)
+
7
8
9
10
V_B
12 V
BYX71
focus
+450 V
AT2140/16
5
4
3
2
e.h.t.
video ampl.
heater
1N4148
0,1 μF
57 V
10 kΩ
1N4148
4,7 μF
(100 V)
+
1 MΩ
1 MΩ
28 V
V_g1
0,1 μF
1,8 kΩ
22 kΩ
680 Ω
0,33 μF
(100 V)
BC548C
BU806
10 nF
AT1076/02
2,2 μF
(100 V)
AT4042/46
amplitude
control
BFS11
47 μF
(400 V)
2,2 MΩ
2,2 MΩ
10 μF
V_g2
130 V
7Z84911

Fig. 3 Application circuit for use with deflection unit AT1076/02 and linearity corrector AT4042/46.

ADJUSTABLE LINEARITY CONTROL UNIT

APPLICATION

This linearity control unit has been designed for use in monochrome monitors with 24 cm (9 in) or 31 cm (12 in) 90° monitor tubes. It can be used in conjunction with deflection unit AT1071/03, line output transformer AT2102/02 and line driver transformer AT4043/56.

DESCRIPTION

The unit consists of a coil wound on a Ferroxcube rod and two Ferroxdure magnets. One of these magnets has the shape of a half ring and is placed around the Ferroxcube rod under the coil. The other magnet is cylindrical; it is placed parallel to and clamped against the Ferroxcube rod opposite the first one. This magnet is provided with a square hole to facilitate turning of it to adjust the biasing field and so the linearity of the line deflection.

MECHANICAL DATA

Dimensions in mm

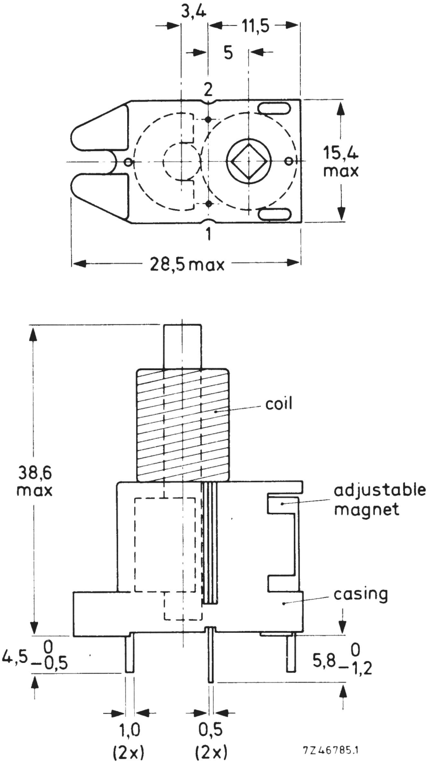


Fig. 1 Adjustable linearity control unit AT4036.

ELECTRICAL DATA

When a sawtooth current (without S-correction) of 6 A (p-p), frequency 15 625 Hz, flyback ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 1,05 and 1,95 V.

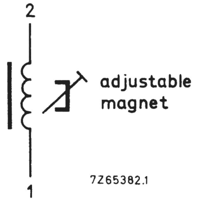


Fig. 2 Circuit diagram.

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 3), or on metal chassis by bending the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 4). To prevent distortion of the magnetic field no iron part should approach the magnetic parts nearer than 3 mm. The coil should be shunted with a 1 W carbon resistor to damp ringing phenomena.

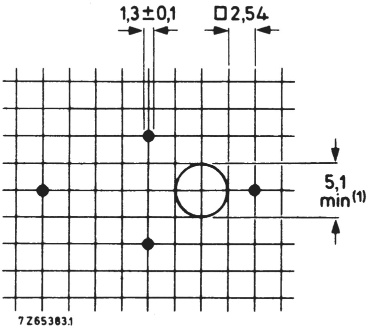


Fig. 3 Hole pattern for mounting on a printed-wiring board.
(1) Hole for bottom adjustment, if required.

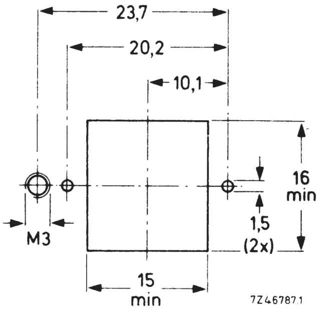


Fig. 4 Hole pattern for mounting on a chassis.

ADJUSTABLE LINEARITY CONTROL UNIT

APPLICATION

This linearity control unit has been designed for use in monochrome monitors with 31 cm (12 in) or 38 cm (15 in) 110° monitor tubes. It can be used in conjunction with deflection unit AT1038/40, line output transformer AT2102/04 and line driver transformer AT4043/59. The unit is also to be used in colour television sets with a 110° colour picture tube.

DESCRIPTION

The unit consists of a coil, mounted on a Ferroxcube rod, two Ferroxdure magnets and one plasto-ferrite magnet. One magnet has the shape of a ring and is placed around the Ferroxcube rod above the coils. One has the shape of a half ring and is placed around the Ferroxcube rod under the coils. The third magnet is cylindrical; it is positioned to and clamped against the Ferroxcube rod opposite the half ring magnet. It is provided with a square hole to facilitate turning to adjust the biasing field and, therefore, the linearity of the line deflection.

MECHANICAL DATA

Dimensions in mm

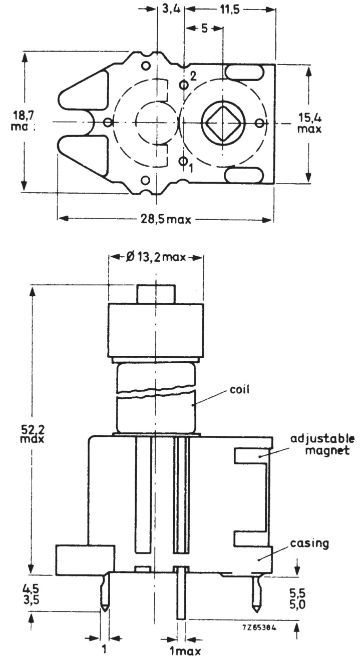


Fig. 1 Adjustable linearity control unit AT4042/08.

ELECTRICAL DATA

When a sawtooth current of 6 A (p-p), frequency 15 625 Hz, fly-back ratio 18% (without S-correction) flows through the linearity control unit (coils connected in parallel, one connection point to earth), the correction voltage is adjustable between 15 and 25 V.
With a sawtooth current of 4,65 A (p-p) the correction voltage is adjustable between 8 and 15 V.

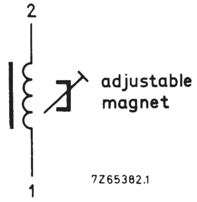


Fig. 2 Circuit diagram.

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins, or on metal chassis by bending the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 4). To prevent distortion of the magnetic field, no iron part should approach the magnetic parts nearer than 3 mm. The coils should be shunted with carbon resistors to damp ringing phenomena; the value of resistor depends on applied line output transformer.

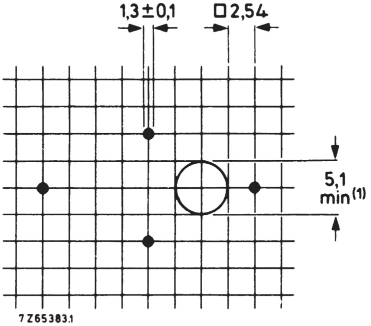


Fig. 3 Hole pattern for mounting on a printed-wiring board.
(1) Hole for bottom adjustment, if required.

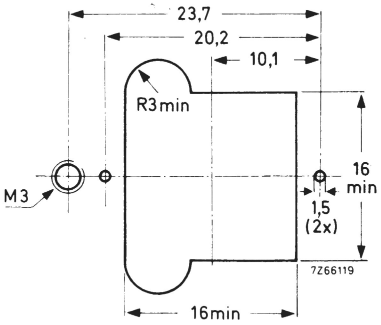


Fig. 4 Hole pattern for mounting on a chassis.

LINEARITY CONTROL UNIT

APPLICATION

This non-adjustable linearity control unit is designed for use in black and white television sets equipped with 110° deflection angle picture tube.

It is intended for use in conjunction with:
- deflection unit AT 1040/15;
- line output transformer AT 2048/12.

DESCRIPTION

The unit consists of a coil wound on a Ferroxcube rod, and a Ferroxdure magnet, which is placed around the rod next to the coil.

Dimensions in mm

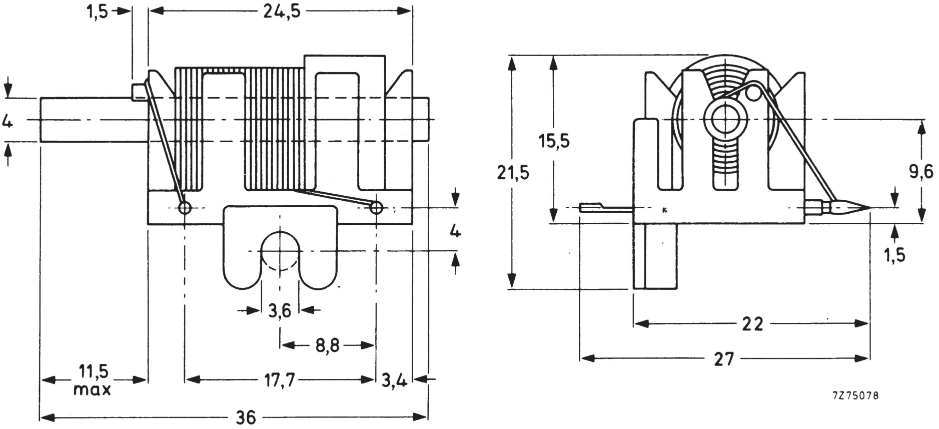


Fig. 1

ELECTRICAL DATA

When a saw-tooth current (without S-correction) of 2,2 A(p-p), frequency 15 625 Hz, flyback ratio 18%, flows through the linearity control unit, the correction voltage is 17 V.

MOUNTING

The unit can be mounted on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 1). To prevent distortion of the magnetic field no iron part should approach the magnetic parts anywhere nearer than 3 mm.

ADJUSTABLE LINEARITY CONTROL UNIT

APPLICATION

This linearity control unit has been designed for use in monochrome monitors with 24 cm (9 in) or 31 cm (12 in) 90° monitor tubes. It can be used in conjunction with deflection unit AT1074/01, line output transformer AT2102/02 or AT2140/10 and line driver transformer AT4043/56.

DESCRIPTION

The unit consists of a coil, mounted on a Ferroxcube rod, two Ferroxdure magnets and one plasto-ferrite magnet. One magnet has the shape of a ring and is placed around the Ferroxcube rod above the coil. One has the shape of a half ring and is placed around the Ferroxcube rod under the coil. The third magnet is cylindrical; it is positioned to and clamped against the Ferroxcube rod opposite the half ring magnet. It is provided with a square hole to facilitate turning to adjust the biasing field and, therefore, the linearity of the line deflection.

MECHANICAL DATA

Dimensions in mm

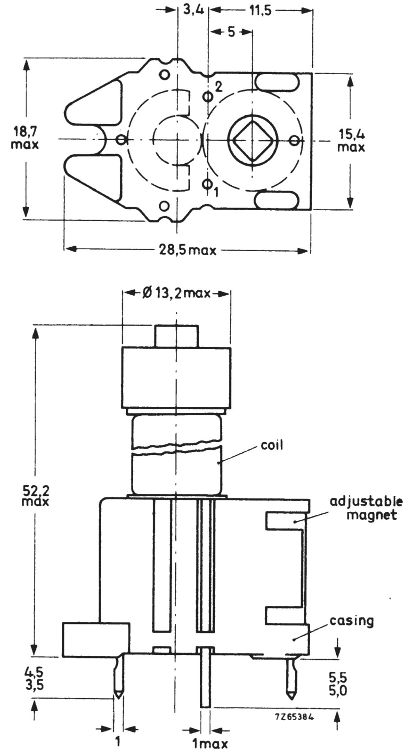


Fig. 1 Adjustable linearity control unit AT4042/26.

ELECTRICAL DATA

When a sawtooth current of 5 A (p-p), frequency 15 625 Hz, fly-back ratio 18% (without S-correction) flows through the linearity control unit (one connection point to earth), the correction voltage is adjusted to 17 V.

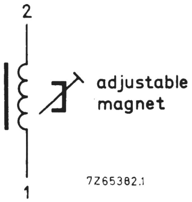

2
adjustable magnet
7Z65382.1
1

Fig. 2 Circuit diagram.

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 3), or on metal chassis by bending the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 4). To prevent distortion of the magnetic field, no iron part should approach the magnetic parts nearer than 3 mm. The coil should be shunted with a 1 W carbon resistor to damp ringing phenomena.

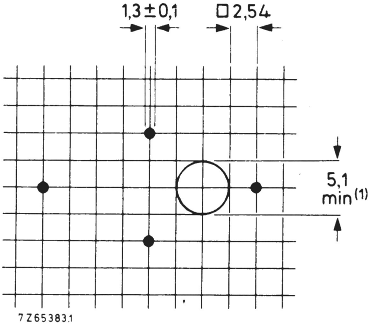

1,3±0,1
□2,54
5,1
min (1)
7Z65383.1

Fig. 3 Hole pattern for mounting on a printed-wiring board.
(1) Hole for bottom adjustment, if required.

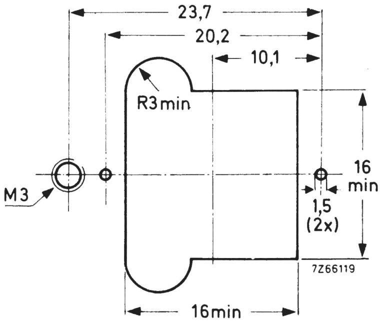

23,7
20,2
10,1
R3min
M3
16
min
1,5
(2x)
7Z66119
16min

Fig. 4 Hole pattern for mounting on a chassis.

LINEARITY CORRECTOR

- For Data Graphic Displays.

APPLICATION

This linearity corrector is for the line deflection output stage of 90° monitors for data graphic display in conjunction with line output transformer AT2140/16 and deflection unit AT1076/01 or AT1076/02.

DESCRIPTION

The linearity corrector consists of a coil, mounted on a Ferroxcube rod and a ring-shaped magnet of plastic-bonded Ferroxdure, which is placed around the rod at the bottom.

The corrector has pins for mounting on a printed-wiring board.

MECHANICAL DATA

Dimensions in mm

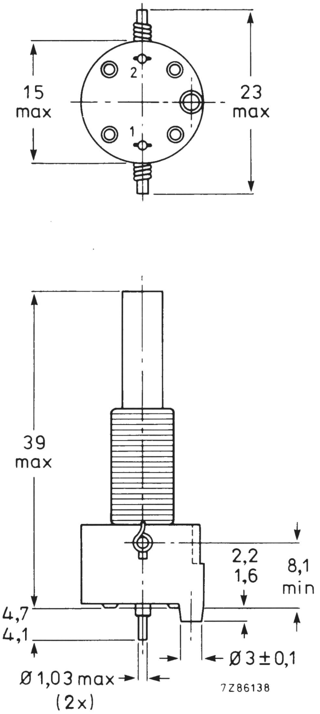


Fig. 1.

Mounting

The AT4042/46 can be mounted on printed-wiring boards by means of its two connection pins, see Fig. 2. To prevent distortion of the magnetic field, no magnetic-conductive materials should approach the magnetic parts nearer than 3 mm. The coil should be shunted with a carbon resistor to damp ringing phenomena; the value of the resistor depends on the line output transformer used (typical value 560 Ω).

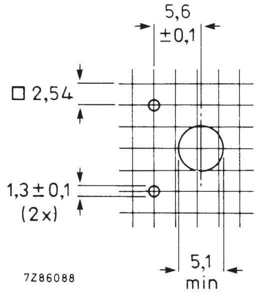


Fig. 2 Hole pattern for mounting on a printed-wiring board.

ELECTRICAL DATA

When a sawtooth current (without S-correction) of 3 A (p-p), frequency 15 625 Hz, flyback ratio 18%, flows through the linearity corrector, the correction voltage is 6 V ± 5,5%.

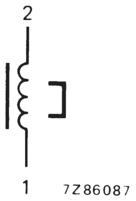


Fig. 3 Circuit diagram.

TESTS

The linearity corrector withstands the following tests:

Vibration	IEC 68-2-6, test Fc, procedure B4; 10-55-10 Hz, amplitude 0,35 mm, 3 x 30 min.
Bump	IEC 68-2-29, test Eb; 40g, 1000 bumps, 3 directions.
Soldering	IEC 68-2-20, test Ta, first part, method 1; 230 ± 10 °C, 2 ± 0,5 s.
Cold	IEC 68-2-1, test Aa; 96 h, −25 °C.
Dry heat	IEC 68-2-2, test Ba; 96 h, + 100 °C.
Damp heat, cyclic	IEC 68-2-30, test Db; 21 days, + 40 °C.
Damp heat, steady state	IEC 68-2-3, test Ca, 21 days.
Change of temperature	IEC 68-2-14, test Na; 5 cycles, T_A = −25 °C, T_B = + 100 °C.
Flammability of assembly	IEC 65, clause 14.4.
Flammability of materials	UL94, category V1.

LINE DRIVER/D.C. SHIFT TRANSFORMER

APPLICATION

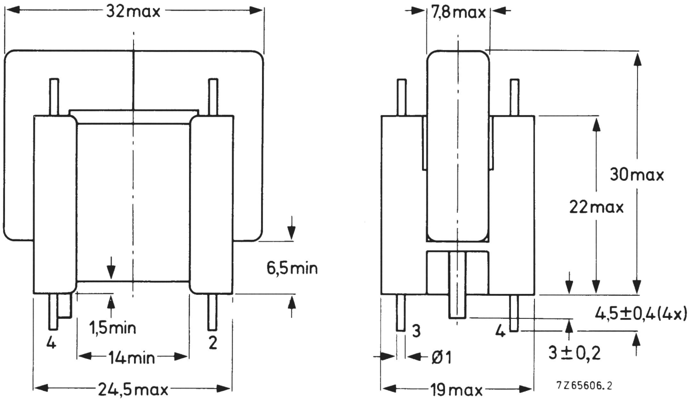
This line driver, or d.c. shift, transformer, is for all transistor colour television receivers and monochrome data graphic display monitors.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit comprises two Ferroxcube U20 cores, grade 3C8. The transformer has four connecting pins and a location pin for mounting on a printed-wiring board.

Outlines



32max
6,5min
1,5min
4
2
14min
24,5max
7,8max
30max
22max
4,5±0,4(4x)
3
4
Ø1
3±0,2
19max
7Z65606.2

Fig. 1.

Mounting

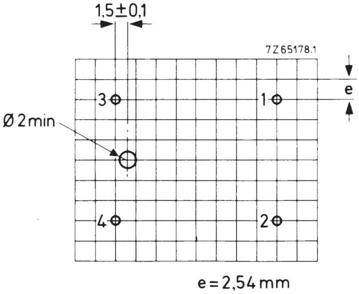
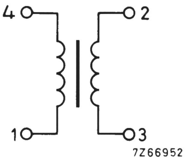

1,5±0,1
7Z65178.1
e
3
1
Ø2min
4
2
e = 2,54 mm

Fig. 2 Hole pattern for mounting on a printed-wiring board, hole diameter 1,3 + 0,1 mm.

ELECTRICAL DATA


4
2
1
3
7Z66952

Inductance primary (1-4)	370 mH ± 12%
Leakage inductance secondary (2-3)*	14 μH ± 20%
Resistance secondary (2-3) at 25 °C	0,35 Ω
Transformation ratio 4-1/2-3	31 : 1
Maximum working temperature	100 °C

---

* Primary short circuited.

LINE DRIVER TRANSFORMER

APPLICATION

This transformer has been designed for use in monochrome monitors. The required supply voltage is 12 V. The transformer is used in conjunction with deflection unit AT1071/03 or AT1074, line-output transformer AT2102/02 or AT2140/10, and linearity control unit AT4036.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U-cores. The unit is provided with pins for mounting on a printed-wiring board.

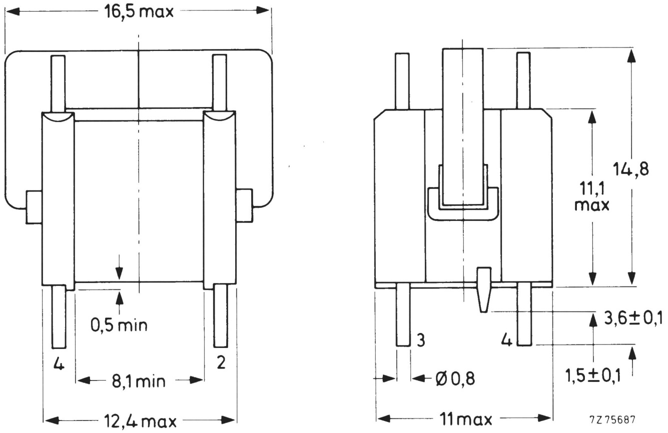

16,5 max
0,5 min
4
2
8,1 min
12,4 max
14,8
11,1 max
3,6±0,1
1,5±0,1
3
4
Ø0,8
11 max
7Z75687

Fig. 1 Line driver transformer AT4043/56.

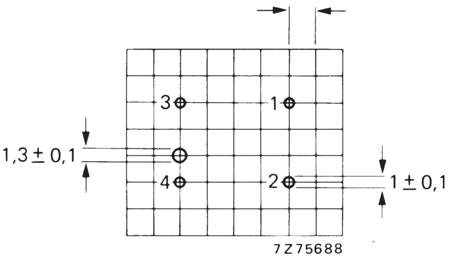
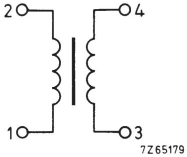

□ 2,54
3
1
1,3 ± 0,1
4
2
1 ± 0,1
7Z75688

Fig. 2 Hole pattern for mounting on a printed-wiring board (component side).

ELECTRICAL DATA

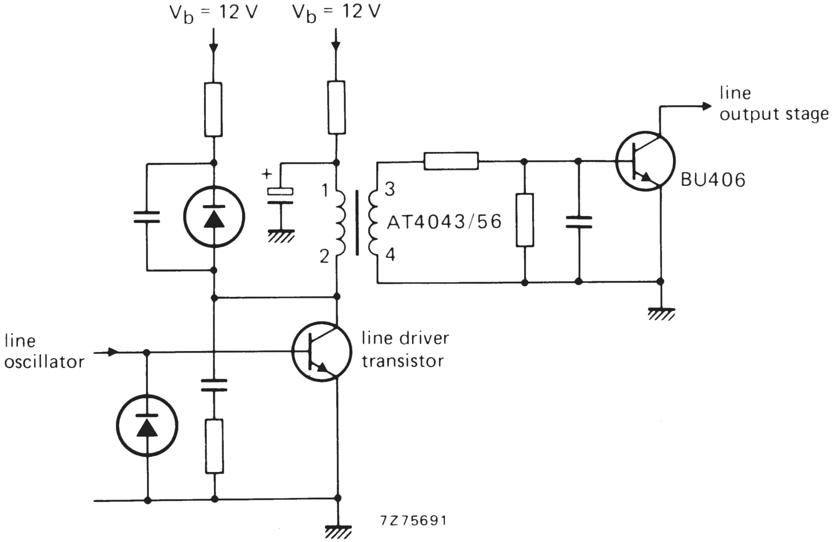
Inductance (primary, 1-2)	5,8 mH ± 15%
Inductance (secondary)	⩽ 10 μH
Transformation ratio	4 : 1
Maximum operating temperature	95 °C



2
4
1
3
7Z65179

Fig. 3 Circuit diagram.

Application circuit



V_b = 12 V
V_b = 12 V
+
1
2
3
4
AT4043/56
line output stage
BU406
line oscillator
line driver transistor
7Z75691

Fig. 4.

LINE DRIVER TRANSFORMER

APPLICATION

This transformer has been designed for use in monochrome monitors. The required supply voltage is 24 V. The transformer is used in conjunction with deflection unit AT1038/40, line-output transformer AT2102/04, and linearity control unit AT4042/08.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U-cores. The unit is provided with pins for mounting on a printed-wiring board.

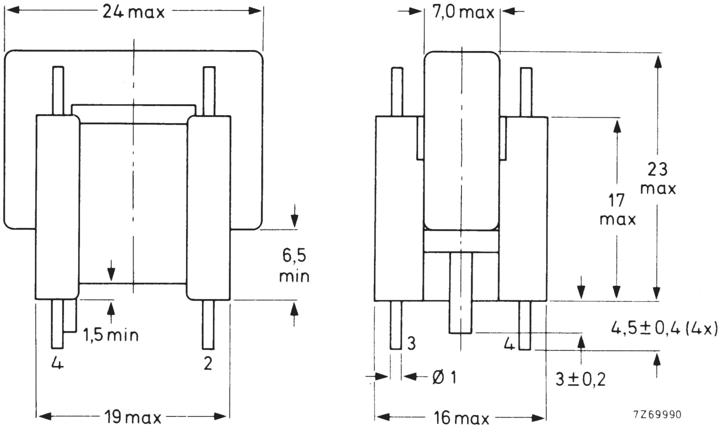

24 max
7,0 max
23 max
17 max
6,5 min
1,5 min
4
2
3
4
Ø 1
4,5 ± 0,4 (4x)
3 ± 0,2
19 max
16 max
7Z69990

Fig. 1 Line driver transformer AT4043/59.

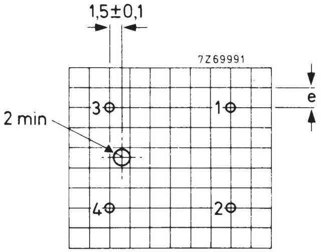

1,5±0,1
7Z69991
3
1
e
2 min
4
2

Fig. 2 Hole pattern for mounting on a printed-wiring board (component side). Hole diameter 1,3 + 0,1 mm. e = 2,54 mm (0,1 in).

ELECTRICAL DATA

Inductance (primary, 1-2)	6,1 mH
Leakage inductance (secondary)	12 μH ± 15%
Transformation ratio	4,18 : 1
Maximum operating temperature	95 °C

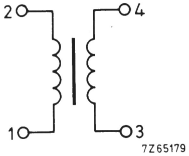

2
4
1
3
7Z65179

Fig. 3 Circuit diagram.

Application circuit

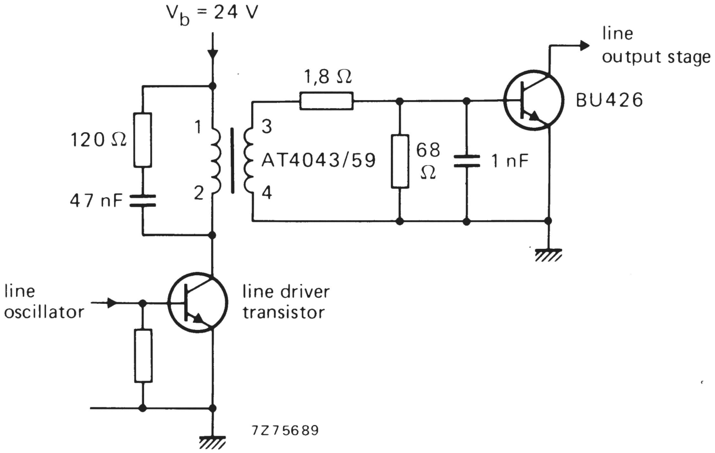

V_b = 24 V
line
output stage
1,8 Ω
BU426
120 Ω
1
3
AT4043/59
68 Ω
1 nF
47 nF
2
4
line
oscillator
line driver
transistor
7Z75689

Fig. 4.

LINE DRIVER TRANSFORMER

APPLICATION

This transformer has been designed for use in monochrome monitors. The required supply voltage is 12 V. The transformer is used in conjunction with deflection unit AT1071/03, line-output transformer AT2102/02, and linearity control unit AT4036.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U-cores. The unit is provided with pins for mounting on a printed-wiring board.

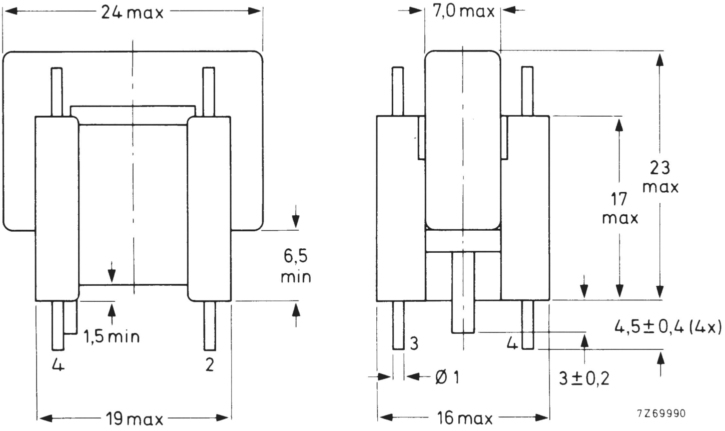

24 max
6,5
min
1,5 min
4
2
19 max
7,0 max
23
max
17
max
4,5 ± 0,4 (4x)
3
4
Ø 1
3 ± 0,2
16 max
7Z69990

Fig. 1 Line driver transformer AT4043/64.

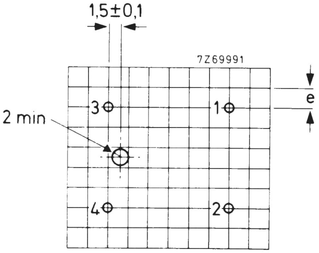

1,5±0,1
7Z69991
3
1
e
2 min
4
2

Fig. 2 Hole pattern for mounting on a printed-wiring board (component side). Hole diameter 1,3 + 0,1 mm. e = 2,54 mm (0,1 in).

ELECTRICAL DATA

Inductance (primary, 1-2)	1,2 mH
Leakage inductance (secondary)	5 μH ± 10%
Transformation ratio	2 : 1
Maximum operating temperature	95 °C

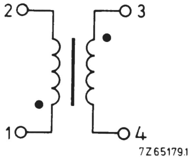

2
3
1
4
7Z65179.1

Fig. 3 Circuit diagram.

Application circuit

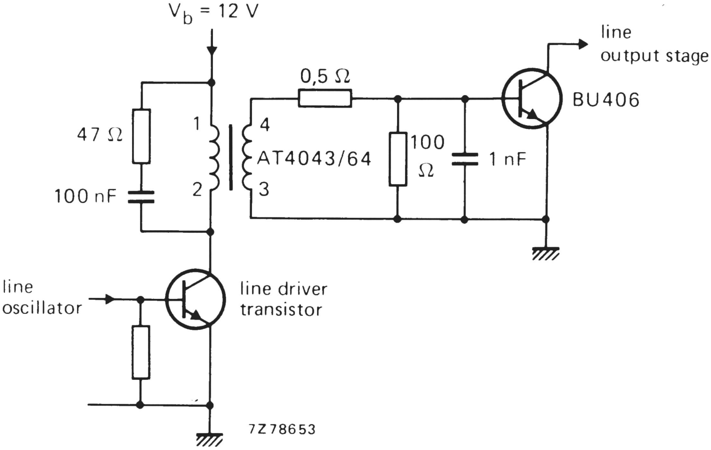

V$_b$ = 12 V
line
output stage
0,5 Ω
BU406
47 Ω
1
4
AT4043/64
2
3
100 nF
100
Ω
1 nF
line
oscillator
line driver
transistor
7Z78653

Fig. 4.

3122 138 96570

DYNAMIC FOCUSING TRANSFORMER

- For Data Graphic Displays

APPLICATION

This transformer has been designed to improve the overall picture sharpness of the CRT. It is applied in series with the line coils of the deflection unit to generate a voltage which is fed to the focus electrode.

MECHANICAL DATA

Dimensions in mm

The magnetic circuit of the transformer comprises two Ferroxcube U20-cores, grade 3C8. The primary and secondary windings are wound on a two-part coil former.

The transformer is provided with 6 pins for mounting on a printed-wiring board.

Outlines

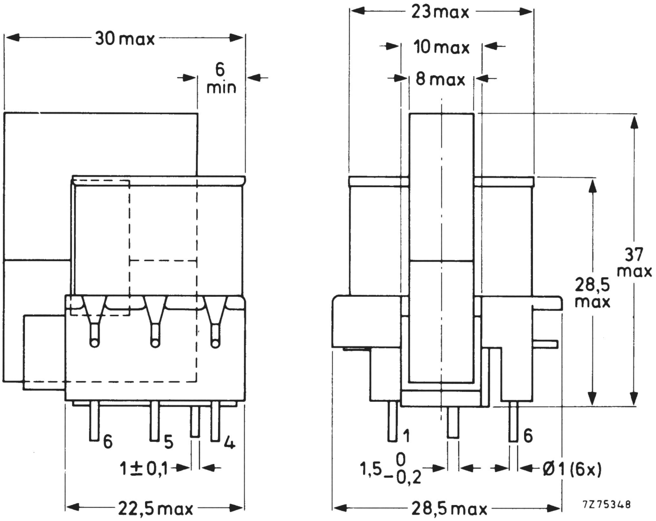

30 max
6 min
23max
10max
8max
37 max
28,5 max
6
5
4
1
6
1±0,1
1,5 $^{0}_{-0,2}$
Ø1 (6x)
22,5max
28,5max
7Z75348

Fig. 1.

Mounting

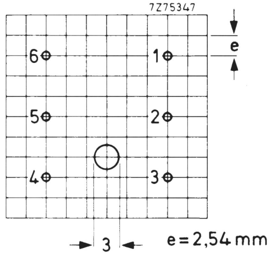

7Z75347
6
1
5
2
4
3
e
3
e = 2,54 mm

Fig. 2 Hole pattern for mounting on a printed-wiring board; hole diameter 1,3 + 0,1 mm. Viewed from the component side.

ELECTRICAL DATA

Inductance, secondary (1-3)*	⩾ 1 H
Resistance, primary (4-6), at 23 °C	⩽ 0,05 Ω
Resistance, secondary (1-3), at 23 °C	⩽ 44 Ω
Voltage ratio $E_{1\text{-}3}/E_{4\text{-}6}$**	60,75 ± 5%
Maximum permissible current (r.m.s. value)	
primary (4-6)	3 A
secondary (1-3)	0,125 A
Mains isolation	according to IEC 65
Breakdown voltage	
between winding 1-3 and winding 4-6 or core	⩾ 5600 V (d.c.)
between winding 4-6 and core	⩾ 500 V (d.c.)
Maximum working temperature	115 °C

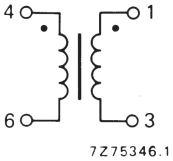

4
1
6
3
7Z75346.1

Fig. 3.

Application circuit

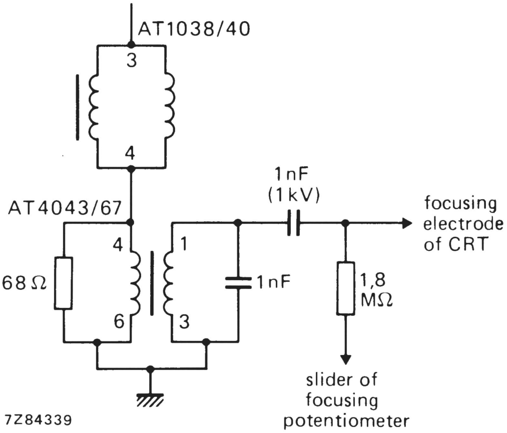

AT1038/40
3
4
AT4043/67
4
1
6
3
68 Ω
1 nF
(1 kV)
1 nF
1,8 MΩ
focusing electrode of CRT
slider of focusing potentiometer
7Z84339

Fig. 4 Application circuit for use with deflection unit AT1038/40.

---

* Measuring condition: E = 20 V, f = 1 kHz.

** Measuring condition: $E_{1\text{-}3}$ = 5 V, f = 1 kHz.

TESTS AND REQUIREMENTS

The dynamic focusing transformer withstands the following tests.

IEC 68–2 test method	name of test	procedure (quick reference)
Ua1	Tensile strength of terminations	
Ub (method 1)	Bending of terminations	
Fc	Vibration	Frequency range 10-55-10 Hz, amplitude 0,35 mm, 3 directions, 30 min per direction.
Eb	Bump	1000 bumps in 6 directions, acceleration 25 g.
Ea	Shock	Half-sine pulse shape, 11 ms, 50g, 6 directions, 3 shocks per direction.
Ta (method 1)	Soldering	Solder temp. 230 °C, dwell time 2 s.
Tb (method 1A)	Resistance to soldering heat	
Bb	Dry heat	96 h at + 100 °C.
Db	Damp heat, cyclic	21 cycles of 24 h at + 40 °C, R.H. 95%.
Ab	Cold	96 h at –40 °C.
Ca	Damp heat, steady state	21 days.
Na	Rapid change of temperature	5 cycles of –25 °C/+ 100 °C.
	Flammability	UAN–L1082, class b.

LINE DRIVER TRANSFORMER

APPLICATION

This transformer has been designed for black and white, and colour television sets equipped with transistors.
In black and white television sets it can be used in the single-transistor (BU205) line output circuit in conjunction with the line output transformer AT2048/12.

For further information see section "Components for colour television".

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	A37-590X	B21
	A42-570X	B39
	A42-590X	B57
	A51-500X	B75
	A51-510X	B77
	A51-540X	B79
	A51-570X	B97
	A51-580X	B115
	A51-590X	B133
	A56-410X	B151
	A56-500X	B153
	A56-510X	B155
	A56-540X	B157
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BLACK AND WHITE TV PICTURE TUBES

Survey		C2
Black and white picture tubes	A24-512W	C3
	A31-322W	C15
	A31-410W	C25
	A31-510W	C37
	A34-111W	C47
	A34-510W	C57
	A44-120W	C67
	A44-510W	C81
	A44-520W	C93
	A50-120W	C105
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	A61-120W	C131
	A61-520W	C145

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	M37-102X/3110	
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Survey		E2
Monochrome monitor tubes	M24-300 series	E3
	M31-320 series	E17
	M31-330 series	E31
	M38-320 series	
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COMPONENTS FOR COLOUR TELEVISION

Survey		F2
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	AT2076/81A	F99
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Linearity corrector	AT4042/30	F119
Adjustable linearity control unit	AT4042/42	F121
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Current sensing transformer	AT4042/46	F127
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	AT4043/63	F133
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Power pack system line choke	AT4043/53	F139
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Driver transformer	AT4043/82	F151
Line driver transformer	AT4043/87	F153
E/W loading coil	AT4044/20	F155
Line balance coil	AT4044/26	F157
Four-pole adjusting coil	AT4044/27	F159
Delay lines	DL270	F161
	DL330	F165
	DL470	F169
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	DL610	F177
	DL700	F181
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Degaussing coils	3122 138 75581	
	3122 138 75941	F203
	3122 138 94350	
	3122 138 94380	F205
	3122 138 94440	F207
	3122 138 99840	
	3122 138 99850	F209

COMPONENTS FOR BLACK AND WHITE TELEVISION AND MONOCHROME DATA GRAPHIC DISPLAY

Survey		G2
Deflection units	AT1038/40	G5
	AT1039/00	
	AT1039/01	G9
	AT1040/15	G17
	AT1071/03	G23
	AT1074	G27
	AT1074/01	G31
	AT1076/01	
	AT1076/02	G35
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	AT2076/51	G45
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	AT2102/06	G63
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Line driver transformer	AT4043/87	G105

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C BLACK AND WHITE TV PICTURE TUBES

D COLOUR MONITOR TUBES
FOR DATA GRAPHIC DISPLAY

E MONOCHROME MONITOR TUBES
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F COMPONENTS FOR COLOUR TELEVISION

G COMPONENTS FOR BLACK AND WHITE TELEVISION
AND MONOCHROME DATA GRAPHIC DISPLAY

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